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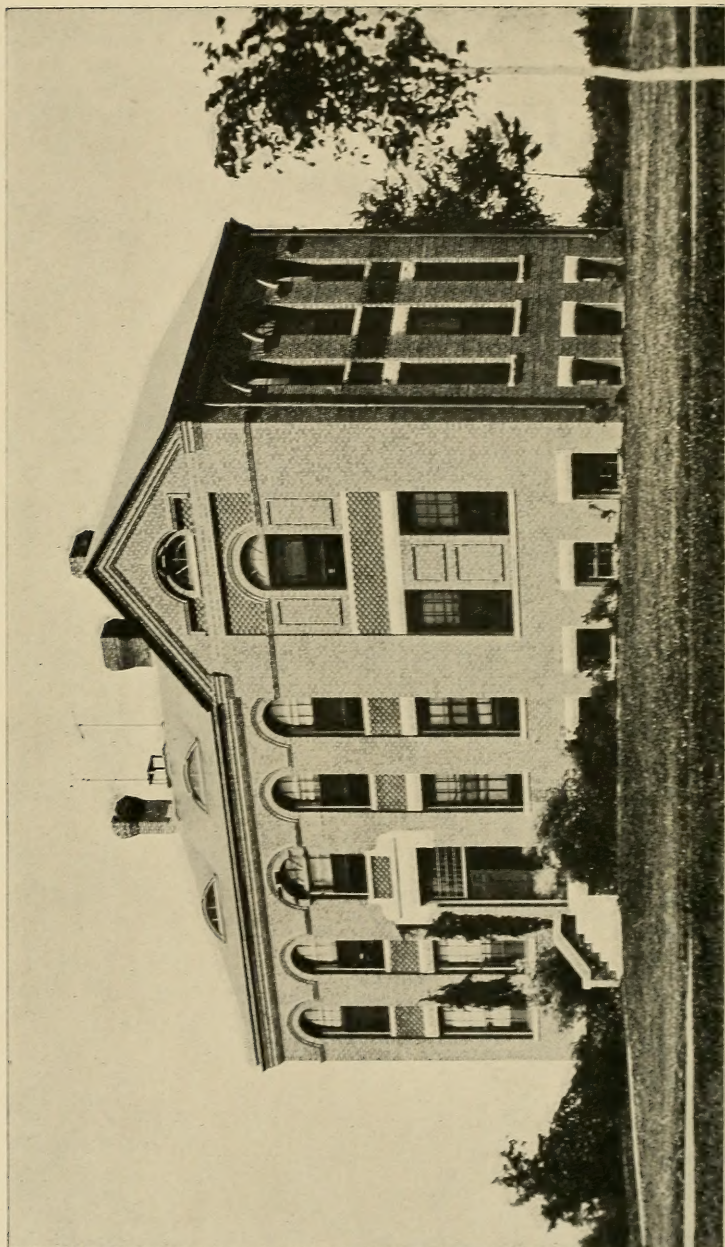
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EXPERIMENT STATION OFFICE.

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SIXTEENTH ANNUAL REPORT

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OF THE

# Maine Agricultural Experiment Station

ORONO, MAINE,

1900.

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AUGUSTA  
KENNEBEC JOURNAL PRINT  
1901

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The Bulletins of this Station will be sent free to any address  
in Maine. All requests should be sent to  
Agricultural Experiment Station,  
Orono, Maine.

STATE OF MAINE.

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*A. W. Harris, Sc. D., President of the University of Maine:*

SIR:—I transmit herewith the Fifteenth Annual Report of the Maine Agricultural Experiment Station for the year ending December 31, 1900.

CHARLES D. WOODS,

*Director.*

ORONO, Maine, December 31, 1900.

# MAINE

## AGRICULTURAL EXPERIMENT STATION

### ORONO, MAINE.

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#### THE STATION COUNCIL.

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GILMAN A. DREW . . . . .	

#### THE STATION STAFF.

##### THE PRESIDENT OF THE UNIVERSITY.

CHARLES D. WOODS . . . . .	<i>Director</i>
JAMES M. BARTLETT . . . . .	<i>Chemist</i>
LUCIUS H. MERRILL . . . . .	<i>Chemist</i>
FREMONT L. RUSSELL . . . . .	<i>Veterinarian</i>
WELTON M. MUNSON . . . . .	<i>Horticulturist</i>
GILBERT M. GOWELL . . . . .	<i>Stock Breeding and Poultry</i>
GILMAN A. DREW . . . . .	<i>Zoologist</i>
LUCIUS J. SHEPARD . . . . .	<i>Assistant in Agriculture</i>
ORA W. KNIGHT . . . . .	<i>Assistant Chemist</i>
EDWARD R. MANSFIELD . . . . .	<i>Assistant Chemist</i>
CLIFFORD D. HOLLEY . . . . .	<i>Assistant Chemist</i>

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## ANNOUNCEMENTS.

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### THE AIM OF THE STATION.

Every citizen of Maine concerned in Agriculture, has the right to apply to the Station for any assistance that comes within its province. It is the wish of the Trustees and Station Council that the Station be as widely useful as its resources will permit.

In addition to its work of investigation, the Station is prepared to make chemical analyses of fertilizers, feeding stuffs, dairy products and other agricultural materials; to test seeds and creamery glass-ware; to identify grasses, weeds, injurious fungi and insects, etc.; and to give information on agricultural matters of interest and advantage to the citizens of the State.

All work proper to the Experiment Station and of public benefit will be done without charge. Work for the private use of individuals is charged for at the actual cost to the Station. The Station offers to do this work only as a matter of accommodation. Under no condition will the Station undertake analyses, the results of which cannot be published, if they prove of general interest.

### INSPECTIONS.

The execution of the laws regulating the sale of commercial fertilizers, concentrated commercial feeding stuffs, and agricultural seeds, and the inspection of chemical glass-ware used by creameries is entrusted to the Director of the Station. The Station officers take pains to obtain for analysis samples of all brands of fertilizers and feeding stuffs coming under the law, but the organized co-operation of farmers is essential for the full and timely protection of their interests. Granges, Farmers Clubs and other organizations can render efficient aid by report-

ing any attempt at evasion of the laws and by sending, early in the season, samples taken from stock *in the market* and drawn in accordance with the Station directions for sampling. In case there should be a number of samples of the same brand sent in, the Station reserves the right to analyze only in part.

#### STATION PUBLICATIONS.

The Station publishes 10 to 12 bulletins each year, covering in detail its expenses, operations, investigations and results. The bulletins are mailed free to all citizens who request them. The annual Report is a reprint of the bulletins of the year and is bound with the Report of the Board of Agriculture and distributed by the Secretary of the Board. This combined report can be obtained by addressing the Secretary of Agriculture, State House, Augusta, Maine.

#### CORRESPONDENCE.

As far as practicable, letters are answered the day they are received. Letters sent to individual officers are liable to remain unanswered, in case the officer addressed is absent. All communications should, therefore, be addressed to the

Agricultural Experiment Station,  
Orono, Maine.

The post office, railroad station, freight, express and telegraph address is Orono, Maine. Visitors to the Station can take the electric cars at Bangor and Old Town.

The telephone call is "Bangor, 27-3."

Directions, forms and labels for taking samples, of fertilizers, feeding stuffs and seeds for analysis can be had on application.

Parcels sent by express should be prepaid, and postage should be enclosed in private letters demanding a reply.

Remittances should be made payable to the undersigned.

CHAS. D. WOODS, *Director.*

## FEEDING STUFF INSPECTION.

CHAS. D. WOODS, Director.

J. M. BARTLETT, chemist in charge of inspection analyses.

### CHIEF REQUIREMENTS OF THE LAW.\*

The points of the law of most interest to dealer and consumer are:

*Kinds of Feed coming within the Law.* The law applies to all feeding stuffs except hays and straws; whole seeds and meals of wheat, rye, barley, oats, Indian corn, buckwheat and broom corn; brans and middlings *not mixed with other substances*, but sold separately, as distinct articles of commerce.

*Inspection tax and tag.* To meet the expenses of inspection, a tax of ten cents per ton must be paid to the Director of the Maine Agricultural Experiment Station. On receipt of the inspection tax, the Director of the Station is required to furnish a tag stating that all charges have been paid. This tag, which bears the Director's signature, shows that the tax has been paid but is *not a guarantee of the quality of the goods*.

*The brand.* Each package of feeding stuff included within the law shall have affixed the inspection tax tag and shall also bear, conspicuously printed; the number of net pounds contained in the package, the name or trade mark under which it is sold, the name of the manufacturer or shipper, the place of manufacture, the place of business or manufacture or shipper, the percentage of crude protein, the percentage of crude fat. These statements may be printed directly on the bag, on a tag attached to the package, or on the back of the inspection tax tag furnished by the Director of the Station. The quality of the goods is guaranteed by the manufacturer, importer or dealer, *and not by the Station*. The samples collected and analyzed by the Station show whether the goods are up to guarantee or not.

The goods must carry the inspection tax tag and the brand before they can be legally offered for sale in the State. It will not answer to affix tags at the time the goods are sold.

*Analysis.* The Director of the Station is required to collect and analyze each year at least one sample of each of the brands of Feeding Stuffs coming within the provisions of the act; and publish the results, together with related matter, from time to time.

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\* The full text of the law will be sent on application.

## MANUFACTURERS AND PLACE OF SAMPLING.

Station number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8841	J. E. Soper & Co .....	Boston, Mass .....	Kennebunk .....
8687	J. E. Soper & Co .....	Boston, Mass .....	Newport .....
8842	Doten Grain Co .....	....., Mass .....	Calais .....
8688	Chapin & Co .....	St. Louis, Mo. ....	Hiram .....
8689	Chapin & Co .....	St. Louis, Mo. ....	Bath .....
8690	Chapin & Co. ....	St. Louis, Mo. ....	Skowhegan .....
8691	Chapin & Co .....	St. Louis, Mo. ....	Dexter .....
8692	Chapin & Co .....	St. Louis, Mo. ....	South Brewer .....
8693	Chapin & Co .....	St. Louis, Mo. ....	Bangor .....
8694	Humphreys, Goodwin & Co ...	Memphis, Tenn. ....	Monmouth .....
8677	E. B. Williams & Co .....	Memphis, Tenn. ....	Bluehill .....
8676	E. B. Williams & Co .....	Memphis, Tenn. ....	Portland .....
8695	E. B. Williams & Co .....	Memphis, Tenn. ....	Lewiston .....
8696	E. B. Williams & Co .....	Memphis, Tenn. ....	South Brewer .....
8697	E. B. Williams & Co .....	Memphis, Tenn. ....	Bangor .....
8698	E. B. Williams & Co .....	Memphis, Tenn. ....	Bangor .....
8835	E. B. Williams & Co .....	Memphis, Tenn. ....	Belfast .....
8699	Humphreys, Goodwin & Co ...	Memphis, Tenn. ....	Auburn .....
8700	F. W. Brod�� & Co .....	Memphis, Tenn. ....	Portland .....
8701	F. W. Brod�� & Co .....	Memphis, Tenn. ....	Westbrook .....
8702	F. W. Brod�� & Co .....	Memphis, Tenn. ....	Bowdoinham .....
8703	F. W. Brod�� & Co .....	Memphis, Tenn. ....	Gardiner .....
8704	F. W. Brod�� & Co .....	Memphis, Tenn. ....	Brunswick .....
8705	F. W. Brod�� & Co .....	Memphis, Tenn. ....	Bethel .....
8836	Arlington Oil & Fertilizer Co ..	Georgia .....	Belfast .....
8840	Arlington Oil & Fertilizer Co ..	Georgia .....	Winterport .....
8706	The American Cotton Oil Co ...	Little Rock, Ark. ....	Corinna .....
8707	The American Cotton Oil Co ...	Little Rock, Ark. ....	Foxcroft .....
8708	The American Cotton Oil Co ...	Little Rock, Ark. ....	Hamden .....
8709	The Southern Cotton Oil Co ....	Little Rock, Ark. ....	Dexter .....
8710	Paris Flouring Co .....	.....	Bangor .....
8711	Unknown .....	.....	Freeport .....
8714	Unknown .....	.....	South Paris .....
8712	Unknown .....	.....	Augusta .....
8713	Unknown .....	.....	Augusta .....
8715	Unknown .....	.....	Dexter .....
8716	Unknown .....	.....	Bangor .....
8717	Unknown .....	.....	Bangor .....
8718	Unknown .....	.....	Bethel .....
8719	The Glucose Sugar Refining Co.	.....	South Brewer .....
8720	The Glucose Sugar Refining Co.	.....	Bucksport .....
8721	The Glucose Sugar Refining Co.	.....	Foxcroft .....
8722	The Glucose Sugar Refining Co.	.....	Corinna .....
8723	The Glucose Sugar Refining Co.	.....	Newport .....
8724	The Glucose Sugar Refining Co.	.....	Biddeford .....
8725	The Glucose Sugar Refining Co.	.....	Bridgton .....
8726	The Glucose Sugar Refining Co.	.....	Augusta .....
8727	The Glucose Sugar Refining Co.	.....	Brunswick .....

## ANALYSES OF SAMPLES.

Name of Feed.	PROTEIN.		FAT.		Station number.
	Found— per cent.	Guaranteed— per cent.	Found— per cent.	Guaranteed— per cent.	
Cotton Seed Meal .....	46.50	43.00	12.12	9.00	8841
Cotton Seed Meal .....	44.40	43.00	13.07	9.00	8687
Cotton Seed Meal .....	43.69	No guar.	12.04	No guar.	8842
Cotton Seed Meal .....	43.69	43.00	13.66	9.00	8688
Cotton Seed Meal .....	44.75	43.00	10.49	9.00	8689
Cotton Seed Meal .....	43.69	43.00	13.86	9.00	8690
Cotton Seed Meal ....	45.19	43.00	10.20	9.00	8691
Cotton Seed Meal .....	45.06	43.00	12.07	9.00	8692
Cotton Seed Meal .....	45.81	43.00	9.46	9.00	8693
Cotton Seed Meal .....	45.06	43.00	9.27	9.00	8694
Cotton Seed Meal .....	43.00	42.00	10.63	8.00	8677
"Daisy Brand" Cotton Seed Meal.....	43.00	43.00	12.10	9.00	8676
"Daisy Brand" Cotton Seed Meal .....	45.31	43.00	8.96	9.00	8695
"Daisy Brand" Cotton Seed Meal .....	45.06	43.00	11.53	9.00	8696
"Daisy Brand" Cotton Seed Meal .....	44.31	43.00	10.76	9.00	8697
"Daisy Brand" Cotton Seed Meal ....	44.56	43.00	11.52	9.00	8698
"Daisy Brand" Cotton Seed Meal ..	45.88	43.00	10.87	9.00	8835
Dixie Brand Cotton Seed Meal.....	44.94	43.00	8.29	9.00	8699
Owl Brand Cotton Seed Meal .....	44.31	43.00	11.88	9.00	8700
Owl Brand Cotton Seed Meal .....	44.06	43.00	13.68	9.00	8701
Owl Brand Cotton Seed Meal .....	37.31	43.00	18.85	9.00	8702
Owl Brand Cotton Seed Meal .....	45.06	43.00	11.91	9.00	8703
Owl Brand Cotton Seed Meal .....	43.19	43.00	11.67	9.00	8704
Owl Brand Cotton Seed Meal .....	44.44	43.00	12.03	9.00	8705
Cotton Seed Meal .....	44.63	43.00	8.69	9.00	8836
Cotton Seed Meal .....	44.94	43.00	10.88	9.00	8840
Prime Cotton Seed Meal .....	41.69	43.00	10.19	9.00	8706
Prime Cotton Seed Meal .....	43.19	43.00	10.35	9.00	8707
Prime Cotton Seed Meal .....	42.31	43.00	10.96	9.00	8708
Prime Finely Ground Cotton Seed Meal	45.56	43.00	11.17	9.00	8709
Prime Memphis Cotton Seed Meal ....	42.69	43.00	13.66	9.00	8710
Cotton Seed Meal .....	43.31	42.00	11.80	8.00	8711
Cotton Seed Meal .....	39.06	42.00	14.06	8.00	8714
Cotton Seed Meal .....	43.44	No guar.	12.83	No guar.	8712
Cotton Seed Meal .....	45.31	No guar.	11.68	No guar.	8713
Cotton Seed Meal .....	45.81	No guar.	11.81	No guar.	8715
Cotton Seed Meal ..	43.56	No guar.	14.10	No guar.	8716
Cotton Seed Meal ...	43.69	No guar.	13.78	No guar.	8717
Sea Island Cotton Seed Meal.....	25.69	No guar.	6.56	No guar.	8718
Chicago Gluten Meal .....	36.31	38.00	4.57	2.00	8719
Chicago Gluten Meal .....	32.81	38.00	4.15	2.00	8720
Chicago Gluten Meal .....	33.31	38.00	4.15	2.00	8721
Chicago Gluten Meal ...	34.56	38.00	4.21	2.00	8722
Chicago Gluten Meal ...	35.19	38.00	4.15	2.00	8723
Chicago Gluten Meal .....	34.56	38.00	4.08	2.00	8724
Chicago Gluten Meal .....	35.44	38.00	3.43	2.00	8725
Chicago Gluten Meal .....	32.94	38.00	4.28	2.00	8726
Chicago Gluten Meal .....	35.06	38.00	4.12	2.00	8727

## MANUFACTURERS—Continued.

Station Number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8728	The Glucose Sugar Refining Co.	.....	Auburn.....
8729	The Glucose Sugar Refining Co.	.....	South Paris.....
8730	The Glucose Sugar Refining Co.	.....	Winthrop.....
8731	The Glucose Sugar Refining Co.	.....	Belfast.....
8732	The Glucose Sugar Refining Co.	.....	Rockland.....
8733	The Glucose Sugar Refining Co.	.....	Bath.....
8734	The Glucose Sugar Refining Co.	.....	Pittsfield.....
8735	The Glucose Sugar Refining Co.	.....	Portland.....
8736	The Glucose Sugar Refining Co.	.....	Stroudwater.....
8737	The Glucose Sugar Refining Co.	.....	Skowhegan.....
8738	Charles Pope Glucose Co.	.....	South Brewer.....
8739	Charles Pope Glucose Co.	.....	Camden.....
8740	Charles Pope Glucose Co.	.....	Lewiston.....
8741	Charles Pope Glucose Co.	.....	Brunswick.....
8742	Charles Pope Glucose Co.	.....	Gardiner.....
8743	Charles Pope Glucose Co.	.....	Freeport.....
8744	Charles Pope Glucose Co.	.....	Saco.....
8745	Charles Pope Glucose Co.	.....	Biddeford.....
8746	Charles Pope Glucose Co.	.....	Westbrook.....
8747	Charles Pope Glucose Co.	.....	Stroudwater.....
8748	Charles Pope Glucose Co.	.....	Portland.....
8749	National Starch Manf'g Co.	Des Moines, Ia....	Portland.....
8750	National Starch Manf'g Co.	Des Moines, Ia....	Auburn.....
8751	National Starch Manf'g Co.	Des Moines, Ia....	South Paris.....
8752	National Starch Manf'g Co.	Des Moines, Ia....	Waterville.....
8753	National Starch Manf'g Co.	Des Moines, Ia....	Dexter.....
8754	National Starch Manf'g Co.	Des Moines, Ia....	Foxcroft.....
8755	National Starch Manf'g Co.	Des Moines, Ia....	Bangor.....
8756	National Starch Manf'g Co.	Indianapolis, Ind..	Milo.....
8757	National Starch Manf'g Co.	Indianapolis, Ind..	Bowdoinham.....
8758	The Glucose Sugar Refining Co.	.....	South Paris.....
8759	The Glucose Sugar Refining Co.	.....	Bangor.....
8760	The Glucose Sugar Refining Co.	.....	Bangor.....
8761	The Glucose Sugar Refining Co.	Rockford, Ill.....	Auburn.....
8762	Norton Chapman Co.	.....	Calais.....
8763	E. W. Blatchford & Co.	Chicago, Ill.....	Brunswick.....
8764	E. W. Blatchford & Co.	Chicago, Ill.....	Gardiner.....
8765	E. W. Blatchford & Co.	Chicago, Ill.....	Freeport.....
8766	The Cleveland Linseed Oil Co.	.....	Westbrook.....
8767	The Cleveland Linseed Oil Co.	.....	Augusta.....
8768	The Cleveland Linseed Oil Co.	.....	Newport.....
8769	The Cleveland Linseed Oil Co.	.....	Pittsfield.....
8770	The Cleveland Linseed Oil Co.	.....	Auburn.....
8771	The Cleveland Linseed Oil Co.	.....	South Paris.....
8772	S. A. & J. H. True Co.	.....	Skowhegan.....
8773	S. A. & J. H. True Co.	.....	South Paris.....
8774	S. A. & J. H. True Co.	.....	Bath.....
			Stroudwater.....

## ANALYSES—Continued.

Name of Feed.	PROTEIN.		FAT.		Station number.
	Found— per cent.	Guaranteed per cent.	Found— per cent.	Guaranteed per cent.	
Chicago Gluten Meal .....	31.69	38.00	3.89	2.00	8728
Chicago Gluten Meal .....	34.94	38.00	2.91	2.00	8729
Chicago Gluten Meal .....	35.56	38.00	5.03	2.00	8730
Chicago Gluten Meal .....	33.19	38.00	5.71	2.00	8731
Chicago Gluten Meal .....	34.06	38.00	5.30	2.00	8732
Chicago Gluten Meal .....	32.44	38.00	4.16	2.00	8733
Chicago Gluten Meal .....	31.56	36.00	4.11	3.37	8734
Chicago Gluten Meal .....	33.44	36.00	4.74	3.37	8735
Chicago Gluten Meal .....	34.06	36.00	4.41	3.37	8736
Chicago Gluten Meal .....	31.56	36.00	3.79	3.37	8737
Cream Gluten Meal.....	32.81	34.12	2.79	3.20	8738
Cream Gluten Meal.....	34.81	34.12	2.93	3.20	8739
Cream Gluten Meal.....	31.44	34.12	2.65	3.20	8740
Cream Gluten Meal.....	31.44	34.12	2.81	3.20	8741
Cream Gluten Meal.....	33.31	34.12	2.45	3.20	8742
Cream Gluten Meal.....	34.06	34.12	1.64	3.20	8743
Cream Gluten Meal.....	30.31	34.12	2.44	3.20	8744
Cream Gluten Meal.....	32.56	34.12	2.57	3.20	8745
Cream Gluten Meal.....	32.69	34.12	2.77	3.20	8746
Cream Gluten Meal.....	34.56	34.12	2.91	3.20	8747
Cream Gluten Meal.....	34.94	34.12	2.91	3.20	8748
King Gluten Meal.....	31.44	32.00	15.88	16.00	8749
King Gluten Meal.....	31.56	32.00	16.26	16.00	8750
King Gluten Meal.....	31.44	32.00	14.86	16.00	8751
King Gluten Meal .....	31.06	32.00	16.28	16.00	8752
King Gluten Meal.....	31.31	32.00	16.18	16.00	8753
King Gluten Meal.....	32.19	32.00	14.25	16.00	8754
King Gluten Meal.....	30.94	32.00	16.05	16.00	8755
King Gluten Meal.....	35.44	32.00	7.21	16.00	8756
King Gluten Meal.....	34.81	32.00	4.81	16.00	8757
Buffalo Gluten Feed ..	25.94	25.50	4.67	4.00	8758
Buffalo Gluten Feed .....	25.56	25.50	4.53	4.00	8759
Buffalo Gluten Feed .....	26.81	25.50	3.80	4.00	8760
Rockford Diamond Gluten Feed.....	25.06	24.20	3.85	3.75	8761
Gluten Feed .....	22.31	24.20	4.04	3.76	8762
Blatchford's Calf Meal .....	25.31	No guar.	5.67	No guar.	8762
Blatchford's Calf Meal .....	25.44	No guar.	5.58	No guar.	8763
Blatchford's Calf Meal .....	24.06	No guar.	5.39	No guar.	8764
Blatchford's Calf Meal .....	24.44	No guar.	5.09	No guar.	8765
Cleveland Flax Meal .....	36.31	39.00	3.45	1.50	8766
Cleveland Flax Meal .....	34.69	39.00	2.90	1.50	8767
Cleveland Linseed Oil Meal .....	38.44	39.00	1.60	1.50	8768
Cleveland Linseed Oil Meal .....	35.81	39.00	3.14	1.50	8769
Cleveland Linseed Oil Meal.....	37.31	39.00	2.44	1.50	8770
Cleveland Linseed Oil Meal .....	38.81	39.00	2.12	1.50	8771
True's Linseed Oil Meal .....	29.81	36.94	8.57	6.58	8772
True's Linseed Oil Meal .....	29.06	36.94	8.40	6.58	8773
True's Linseed Oil Meal .....	33.44	36.94	9.45	6.58	8774

## MANUFACTURERS—Continued.

Station number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8775	International Milling Co.....	.....	Brunswick.....
8776	International Milling Co.....	.....	Foxcroft.....
8777	S. A. & J. H. True Co. ....	.....	Portland.....
8778	O. Holway & Co. ....	Auburn.....	Auburn.....
8779	O. Holway & Co. ....	Auburn.....	Winthrop.....
8780	O. Holway & Co. ....	Auburn.....	Foxcroft.....
8781	The American Cereal Co.....	Chicago, Ill.....	Portland.....
8782	The American Cereal Co.....	Chicago, Ill.....	Portland.....
8783	The American Cereal Co.....	Chicago, Ill.....	Saco.....
8784	The American Cereal Co.....	Chicago, Ill.....	Augusta.....
8785	The American Cereal Co.....	Chicago, Ill.....	Brunswick.....
8786	The American Cereal Co.....	Chicago, Ill.....	Auburn.....
8787	The American Cereal Co.....	Chicago, Ill.....	Bethel.....
8788	The American Cereal Co.....	Chicago, Ill.....	Monmouth.....
8789	The American Cereal Co.....	Chicago, Ill.....	Belfast.....
8790	The American Cereal Co.....	Chicago, Ill.....	Bath.....
8844	The American Cereal Co.....	Chicago, Ill.....	Eastport.....
8791	The American Cereal Co.....	Chicago, Ill.....	Skowhegan.....
8792	The American Cereal Co.....	Chicago, Ill.....	Newport.....
8793	The American Cereal Co.....	Chicago, Ill.....	Bucksport.....
8794	The American Cereal Co.....	Chicago, Ill.....	South Brewer.....
8795	The American Cereal Co.....	Chicago, Ill.....	Bangor.....
8846	The American Cereal Co.....	Chicago, Ill.....	Calais.....
8796	The American Cereal Co.....	Chicago, Ill.....	Brunswick.....
8797	The American Cereal Co.....	Chicago, Ill.....	Auburn.....
8798	The American Cereal Co.....	Chicago, Ill.....	Camden.....
8799	The American Cereal Co.....	Chicago, Ill.....	Foxcroft.....
8800	The American Cereal Co.....	Chicago, Ill.....	Portland.....
8801	The American Cereal Co.....	Chicago, Ill.....	Stroudwater.....
8802	The American Cereal Co.....	Chicago, Ill.....	Saco.....
8803	The American Cereal Co.....	Chicago, Ill.....	Augusta.....
8804	The American Cereal Co.....	Chicago, Ill.....	Brunswick.....
8805	The American Cereal Co.....	Chicago, Ill.....	Bath.....
8845	The American Cereal Co.....	Chicago, Ill.....	Eastport.....
8806	The H-O Co.....	Buffalo, N. Y.....	Freeport.....
8807	The H-O Co.....	Buffalo, N. Y.....	Augusta.....
8808	The H-O Co.....	Buffalo, N. Y.....	Waterville.....
8809	The H-O Co.....	Buffalo, N. Y.....	Rockland.....
8810	The H-O Co.....	Buffalo, N. Y.....	Skowhegan.....
8811	The H-O Co.....	Buffalo, N. Y.....	Portland.....
8812	The H-O Co.....	Buffalo, N. Y.....	Freeport.....
8813	The H-O Co.....	Buffalo, N. Y.....	Auburn.....
8814	The H-O Co.....	Buffalo, N. Y.....	Waterville.....
8815	The H-O Co.....	Buffalo, N. Y.....	Skowhegan.....
8816	The H-O Co.....	Buffalo, N. Y.....	Freeport.....
8817	The H-O Co.....	Buffalo, N. Y.....	Freeport.....
8818	The American Cereal Co.....	Chicago, Ill.....	Portland.....
8819	The American Cereal Co.....	Chicago, Ill.....	Auburn.....

## ANALYSES—Continued.

Name of Feed.	PROTEIN.		FAT.		Station number.
	Found— per cent.	Guaranteed per cent.	Found— per cent.	Guaranteed— per cent.	
Sucrene Oil Meal.....	23.31	24.75	3.53	3.50	8775
Sucrene Oil Meal. ....	26.94	24.75	3.65	3.50	8776
True's Corn and Oat Feed.....	9.31	9.63	3.45	4.23	8777
Monarch Corn and Oat Feed.....	10.94	10.25	8.29	7.47	8778
Monarch Corn and Oat Feed.....	9.81	10.25	7.16	7.47	8779
Monarch Corn and Oat Feed.....	9.94	10.25	7.56	7.47	8780
Victor Corn and Oat Feed.....	8.19	9.46	3.84	3.92	8781
Victor Corn and Oat Feed.....	7.31	9.46	3.55	3.92	8782
Victor Corn and Oat Feed.....	8.44	9.46	3.49	3.92	8783
Victor Corn and Oat Feed....	7.31	9.46	3.23	3.92	8784
Victor Corn and Oat Feed.....	7.94	9.46	3.46	3.92	8785
Victor Corn and Oat Feed.....	7.94	9.46	3.68	3.92	8786
Victor Corn and Oat Feed.....	8.56	9.46	3.71	3.92	8787
Victor Corn and Oat Feed....	8.06	9.46	3.31	3.92	8788
Victor Corn and Oat Feed.....	8.19	9.46	3.60	3.92	8789
Victor Corn and Oat Feed.....	7.56	9.46	3.18	3.92	8790
Victor Corn and Oat Feed.....	9.94	9.46	4.91	3.92	8844
Victor Corn and Oat Feed.....	9.69	9.46	5.12	3.92	8791
Victor Corn and Oat Feed.....	7.56	9.46	3.15	3.92	8792
Victor Corn and Oat Feed.....	7.81	9.46	3.21	3.92	8793
Victor Corn and Oat Feed.....	8.81	9.46	4.06	3.92	8794
Victor Corn and Oat Feed. ....	8.69	9.46	4.14	3.92	8795
Corn, Oats and Barley. ....	10.81	11.26	4.98	4.15	8846
Quaker Dairy Feed .....	10.31	12.03	3.19	3.49	8796
Quaker Dairy Feed .....	11.56	12.03	3.44	3.49	8797
Quaker Dairy Feed .....	13.69	12.03	4.13	3.49	8798
Quaker Dairy Feed .....	13.81	12.03	3.40	3.49	8799
Quaker Oat Feed.....	11.31	12.03	4.35	3.49	8800
Quaker Oat Feed.....	12.94	12.03	3.73	3.49	8801
Quaker Oat Feed.....	11.94	12.03	3.67	3.49	8802
Quaker Oat Feed..	11.06	12.03	3.62	3.49	8803
Quaker Oat Feed.....	13.94	12.03	3.69	3.49	8804
Quaker Oat Feed.....	14.56	12.03	3.77	3.49	8805
Quaker Oat Feed.....	13.69	12.03	4.08	3.49	8845
The H-O Co.'s Dairy Feed.....	17.44	18.00	4.84	4.50	8806
The H-O Co.'s Dairy Feed.....	16.94	18.00	4.71	4.50	8807
The H-O Co.'s Dairy Feed.....	17.63	18.00	5.32	4.50	8808
The H-O Co.'s Dairy Feed.....	18.50	18.00	4.63	4.50	8809
The H-O Co.'s Dairy Feed. ....	18.63	18.00	4.81	4.50	8810
The H-O Co.'s Dundee Corn & Oat Feed	8.13	8.38	3.42	2.95	8811
The H-O Co.'s Dundee Corn & Oat Feed	8.56	8.38	3.31	2.95	8812
The H-O Co.'s Dundee Corn & Oat Feed	8.19	8.38	3.24	2.95	8813
The H-O Co.'s Dundee Corn & Oat Feed	8.44	8.38	2.98	2.95	8814
The H-O Co.'s Dundee Corn & Oat Feed	8.00	8.38	3.59	2.95	8815
The H-O Co.'s Horse Feed.....	12.19	12.30	4.42	4.90	8816
The H-O Co.'s Poultry Feed.....	15.31	16.80	6.36	7.00	8817
American Cereal Co.'s Poultry Feed...	8.31	No guar.	6.32	No guar.	8818
American Cereal Co.'s Poultry Feed...	12.06	No guar.	6.06	No guar.	8819

## MANUFACTURERS—Concluded.

Station number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8820	Unknown .....	East Boston, Mass.	Freeport .....
8821	B. Randall & Co .....	South Brewer.....	Bowdoinham .....
8822	Nash Manufacturing Co .....		Winterport .....
8823	Nash Manufacturing Co .....	South Brewer.....	Bangor .....
8824	The Bowker Co .....	Boston, Mass.....	Portland .....
8825	The Bowker Co .....	Boston, Mass.....	Freeport .....
8826	The Bowker Co.....	Boston, Mass.....	Gardiner .....
8827	The Bowker Co.....	Boston, Mass.....	Belfast .....
8828	The Bowker Co .....	Boston, Mass.....	Portland .....
8829	Bradley Fertilizer Co.....	Boston, Mass.....	Portland .....
8830	Bradley Fertilizer Co.....	Boston, Mass.....	Bangor .....
8831	Nash Manufacturing Co .....	South Brewer.....	South Brewer....

## ANALYSES—Concluded.

Name of Feed.	PROTEIN.		FAT.		Station number.
	Found— per cent.	Guaranteed per cent.	Found— per cent.	Guaranteed per cent.	
Rice Feed....	10.69	No guar.	11.31	No guar.	8820
American Poultry Meal .....	35.00	No guar.	23.88	No guar.	8821
Nash Manufacturing Co.'s Beef Scraps	46.94	52.19	26.41	28.42	8822
Nash Manufacturing Co.'s Beef Scraps	42.94	52.19	27.29	28.42	8823
Bowker's Animal Meal .....	43.56	30.00	10.15	5.00	8824
Bowker's Animal Meal .....	45.56	30.00	11.06	5.00	8825
Bowker's Animal Meal .....	46.06	30.00	9.37	5.00	8826
Bowker's Animal Meal .....	42.81	30.00	10.51	5.00	8827
Bowker's Pure Beef Scraps .....	48.50	No guar.	17.14	No guar.	8828
Bradley's Superior Meat Meal .....	45.69	40.00	10.93	10.00	8829
Bradley's Superior Meat Meal .....	47.94	40.00	9.47	10.00	8830
Cattle or Poultry Bone .....	16.06	11.00	5.87	.....	8831

## SUMMARY OF ANALYSES.

	Number of analyses.		PROTEIN.		FAT.	
			Found— per cent.	Guaranteed— per cent.	Found— per cent.	Guaranteed— per cent.
J. E. Soper & Co.'s Cotton Seed Meal.	2	Highest Lowest Average	46.50 44.40 45.45	..... 43.00 .....	13.07 12.12 12.60	9.00
Chapin & Co.'s Cotton Seed Meal.	6	Highest Lowest Average	45.81 43.69 44.70	..... 43.00 .....	13.86 9.46 11.62	9.00
Humphreys, Goodwin & Co.'s Cotton Seed Meal.	1	.....	45.06	43.00	9.27	9.00
Humphreys, Goodwin & Co.'s Dixie Brand Cotton Seed Meal.	1	.....	44.94	43.00	8.29	9.00
E. B. Williams & Co.'s Cotton Seed Meal.	1	.....	43.00	42.00	10.63	8.00
E. B. Williams & Co.'s "Daisy Brand" Cotton Seed Meal.	6	Highest Lowest Average	45.88 43.00 44.69	..... 43.00 .....	12.10 8.96 10.96	9.00
F. W. Brod� & Co.'s Owl Brand Cotton Seed Meal.	6	Highest Lowest Average	45.06 37.31 43.06	..... 43.00 .....	13.85 11.67 13.34	9.00
The American Cotton Oil Co.'s Prime Cotton Seed Meal.	3	Highest Lowest Average	43.19 41.69 42.40	..... 43.00 .....	10.96 10.19 10.50	9.00
The Southern Cotton Oil Co.'s Prime, Finely Ground Cotton Seed Meal.	1	.....	45.56	43.00	11.17	9.00
Arlington Oil & Fertilizer Co.'s Cotton Seed Meal.	2	Highest Lowest Average	44.94 44.63 44.79	..... 43.00 .....	10.88 8.69 9.79	9.00
Doten Grain Co.'s Cotton Seed Meal.	1	.....	43.69	.....	12.04	
Paris Flouring Co.'s Prime Memphis Cotton Seed Meal.	1	.....	42.69	43.00	13.66	9.00
Manufacturers Unknown. Cotton Seed Meal.	2	Highest Lowest Average	43.31 39.06 41.19	..... 42.00 .....	14.06 11.80 12.93	8.00
Manufacturers Unknown. Unguaranteed Cotton Seed Meal.	5	Highest Lowest Average	45.81 43.44 44.36	..... ..... .....	14.10 11.68 12.84	
Average of Cotton Seed Meals.	38	Average	43.98	.....	11.79	
Sea Island Cotton Seed Meal...	1	.....	25.69	.....	6.56	
The Glucose Sugar Refin'g Co.'s Chicago Gluten Meal.	19	Highest Lowest Average	36.31 31.56 33.80	38.00 ..... .....	5.71 2.91 4.24	2.00
Charles Pope Glucose Co.'s Cream Gluten Meal.	11	Highest Lowest Average	34.94 30.31 32.99	..... 34.12 .....	2.93 1.64 2.63	3.20

## SUMMARY OF ANALYSES—Continued.

	Number of analyses.		PROTEIN.		FAT.	
			Found— per cent.	Guaranteed— per cent.	Found— per cent.	Guaranteed— per cent.
National Starch Man'g Co.'s King Gluten Meal from Des Moines Mill.	7	Highest Lowest Average	32.19 30.94 31.42	..... 32.00 .....	16.28 14.25 15.68	16.00
The National Starch Man. Co.'s King Gluten Meal from In- dianapolis Mill.	2	Highest Lowest Average	35.44 34.51 35.13	..... 32.00 .....	7.21 4.81 6.01	16.00
The Glucose Sugar Refin'g Co.'s Buffalo Gluten Feed.	3	Highest Lowest Average	26.81 25.56 26.10	..... 25.50 .....	4.67 3.80 4.33	4.00
The Glucose Sugar Refin'g Co.'s Rockford Diamond Gluten Feed.	1	... ..	25.06	24.20	3.85	3.78
Norton Chapman Co.'s Gluten Feed.	1	... ..	22.31	24.20	4.04	3.76
E. W. Blatchford & Co.'s Blatchford's Calf Meal.	4	Highest Lowest Average	25.44 24.06 24.81	..... ..... .....	5.67 5.09 5.43	
The Cleveland Linseed Oil Co.'s Cleveland Flax Meal.	2	Highest Lowest Average	36.31 34.69 35.50	..... 39.00 .....	3.45 2.90 3.17	1.50
The Cleveland Linseed Oil Co.'s Linseed Oil Meal.	4	Highest Lowest Average	38.81 35.81 37.59	..... 39.00 .....	3.14 1.60 2.32	1.50
S. A. & J. H. True Co.'s Linseed Oil Meal.	3	Highest Lowest Average	33.44 29.06 30.77	..... 36.94 .....	9.45 8.40 8.81	6.58
International Milling Co.'s Sucrene Oil Meal.	2	Highest Lowest Average	26.94 23.31 25.12	..... 24.75 .....	3.65 3.53 3.59	3.50
S. A. & J. H. True Co.'s Corn and Oat Feed.	1	.....	9.31	9.63	3.45	4.23
O. Holway & Co.'s Monarch Corn and Oat Feed.	3	Highest Lowest Average	10.94 9.81 10.23	..... 10.25 .....	8.29 7.16 7.67	7.47
The American Cereal Co.'s Victor Corn and Oat Feed.	16	Highest Lowest Average	9.94 7.31 8.25	..... 9.46 .....	5.12 3.15 3.73	3.92
The American Cereal Co.'s Corn, Oats and Barley.	1	.....	10.81	11.26	4.98	4.15
The American Cereal Co.'s Quaker Dairy Feed.	4	Highest Lowest Average	13.81 10.31 12.34	..... 12.03 .....	4.13 3.19 3.54	3.49
The American Cereal Co.'s Quaker Oat Feed.	7	Highest Lowest Average	14.56 11.06 12.78	..... 12.03 .....	4.35 3.62 3.84	3.49
The H-O Co.'s Dairy Feed.	5	Highest Lowest Average	18.63 16.94 17.83	..... 18.00 .....	5.32 4.63 4.86	4.50

## SUMMARY OF ANALYSES—Concluded.

	Number of analyses.		PROTEIN.		FAT.	
			Found— per cent.	Guaranteed— per cent.	Found— per cent.	Guaranteed— per cent.
The H-O Co.'s Dundee Corn and Oat Feed.	5	Highest Lowest Average	8.56 8.00 8.26	..... 8.38 .....	3.59 2.98 3.31	2.95
The H-O Co.'s Horse Feed.	1	.....	12.19	12.30	4.42	4.90
The H-O Co.'s Poultry Feed.	1	.....	15.31	16.80	6.36	7 00
American Cereal Co.'s Poultry Feed.	2	Highest Lowest Average	12.06 8.31 10.18	..... ..... .....	6.32 6.06 6.19	
Rice Feed.	1	.....	10.69	No guar.	11.31	
B. Randall & Co.'s American Poultry Meal.	1	.....	35.00	.....	23.88	
Nash Manufacturing Co.'s Beef Scraps.	2	Highest Lowest Average	46.94 42.94 44.94	..... 52.19 .....	27.29 26.41 26.85	28.42
The Bowker Co.'s Bowker's Animal Meal.	4	Highest Lowest Average	46.06 42.81 44.51	..... 30.00 .....	11.06 9.37 10.27	5 00
The Bowker Co.'s Bowker's Pure Beef Scraps.	1	.....	48.50	.....	17.14	
Bradley Fertilizer Co.'s Bradley's Superior Meat Meal	2	Highest Lowest Average	47.94 45.69 46.82	..... 40.00 .....	10.93 9.47 10.20	10.00
Nash Manufacturing Co.'s Cattle or Poultry Bone.	1	.....	16.06	11.00	5.87	

## VIOLATIONS OF THE LAW.

Because of the newness of the law and that its requirements would be unwittingly violated, after consulting with the Secretary of the Board of Agriculture it was deemed best that for a year or two the Director directly notify delinquents and only report to the Secretary cases of willful and persistent failure to comply with the law. Last October the law had been in operation two years, long enough time for dealers to become familiar with its requirements and it seemed time to see that the law is literally complied with in every instance. Accordingly each violation of the law reported by inspectors and each substantiated complaint from consumers has been, since December,

1899, reported by the Director to the Secretary of Agriculture who has given the formal notice to the delinquents required by law. Subsequent violations by dealers who have been thus notified will make them liable to prosecution without further notice.

The total number of violations thus reported are 38, of which 22 are for offering goods without having the tax tag affixed. In nearly all of these cases the dealers had the tags in the office and claimed that they attached them at the time of sale. In 16 instances the goods did not carry the guarantee. The goods thus unbranded consisted of 4 lots of Blatchford's calf meal (of which there is little sold) 1 lot of beef scrap for poultry, 1 lot of poultry meal, 1 car of rice feed, 2 small lots of American Cereal Company's poultry feed, 1 car Victor corn and oat feed, and 7 lots of cottonseed meal. One of the cottonseed meals was old low grade goods which were in stock (and which the dealer had analyzed by the Station in 1897) when the law went into effect; the other cottonseed meals were high grade goods from houses that have usually fully complied with the requirements of the law. The dealer did not know that the rice feed was subject to the law. It was the first he had handled (and the first reported to the Station). Before selling, the law was complied with. The American Cereal Company did not know that the law applied to poultry foods and will in the future see that these goods are tagged before they leave the mill. As Victor corn and oat feed is all tagged at the mill, it would seem that a car not intended for this State was shipped here. Two cars of feeds with Vermont tags were shipped into the State; the jobber provided Maine tags for them, however.

#### GUARANTEES AND RESULTS OF ANALYSES.

As in the past cottonseed meal, both in number of brands and in carloads sold, probably leads the concentrated feeds coming under the law. Only one lot of Sea Island cottonseed meal was found by the inspector and that was in the State in 1897 when the law went into effect.

One lot of Owl Brand cottonseed meal carried only 37.31 per cent of protein. Five other samples carried from 43.19 per cent to 45.06 per cent. As the sample low in protein carried 18.85 per cent of fat instead of 12 per cent as the others did, the

low protein is probably explained by the fact that the oil was not as completely expressed as usual. On this account the case was not reported to the Secretary of Agriculture.

In 1897-8 the American Cotton Oil Company's cottonseed meal was one of the best in the State, averaging about 45 per cent of protein. The quality of this output has steadily decreased, and only one of the three lots sampled were up to guarantee: the others carried 41.69 and 42.31 per cent with a guarantee of 43 per cent protein. All of the other samples of cottonseed agreed fairly well with the guarantees.

The sample of the Sea Island cottonseed meal was from a lot 3 years or more old. While in 1896 and 1897 considerable of these low grade cottonseed meals were sold in the State, so far as we can learn, (and we investigate every suspicious case reported to us) there is very little now sold.

Chicago gluten meal changes in composition very greatly from time to time as the following comparisons show:

	Number of samples.	PROTEIN.			FAT.		
		Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
Winter 1898 .....	15	38.38	34.00	35.64	4.15	2.48	3.37
Fall 1898 .....	14	40.63	36.13	38.01	2.79	1.70	2.15
Winter 1899 .....	14	38.94	34.50	37.42	3.61	2.27	3.01
Fall 1899 .....	19	36.31	31.56	33.88	5.30	2.91	4.27

These goods are guaranteed 38 per cent protein and 2 per cent fat. The Norton-Chapman Company of Portland are the State agents and all of the goods sold in the State are guaranteed by them. These goods contain substantially less protein than guaranteed and the dealers have been reported to the Secretary of Agriculture.\*

Five of the 11 samples of the Cream gluten meal fall below the guarantee in protein and the other 6 are but little above.

\* Five samples of Chicago gluten sent to the Station in January by the State agents were above guarantee.

The guarantee is 34.12 per cent protein and 3.20 per cent fat, and the average of the 11 analyses is 32.99 per cent protein and 2.63 per cent fat.

King gluten meal from the Des Moines mill agrees fairly well in composition with its guarantee, being on the average .6 per cent below in protein and .3 per cent in fat. The King gluten from the Indianapolis mill is richer in protein and lower in fat and more nearly resembles Chicago gluten meal in composition. It is much below the guarantee in fat, but is three per cent above the guarantee in protein.

Buffalo gluten feed agrees quite closely with the guarantee of 25.50 per cent protein and 4 per cent fat.

Blatchford's Calf meal was not guaranteed. The dealers were reported to the Secretary of Agriculture.

Cleveland Flax meal is much below the guarantee in protein. The two lots examined have been reported to the Secretary of Agriculture. The average of four samples of Cleveland linseed oil meal shows it to be 1 per cent below guarantee in protein.

S. A. & J. H. True Company's linseed oil meal averages 7 per cent below the guarantee in protein; the cases have been reported to the Secretary of Agriculture.

The International Milling Company's Sucrene Oil meal agrees fairly well with the guarantee. The same is true of S. A. & J. H. True Company's corn and oat feed and monarch oat feed. Victor corn and oat feed runs lower in protein than in the past. It is guaranteed to carry 9.46 per cent protein. While two samples carried more protein than this, two samples had only 7.31 per cent and 16 samples averaged 8.25 per cent of protein.

Dairy feed, Quaker oat feed, the H-O Company's feed, the H-O Company's Dundee corn and oat feed, the H-O Company's horse feed, and the H-O Company's poultry feed all practically agreed with the guarantee.

The guarantee of Nash Manufacturing Company's beef scrap was based upon an analysis made by the Station of a sample which they sent for that purpose. Evidently the sample did not represent the output. The company and the dealers have been reported to the Secretary of Agriculture. The other poultry meals analyze above their guarantee. The Bowker Company have furnished a guarantee for their beef scraps.

## FERTILIZER INSPECTION.

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CHAS D. WOODS, Director.

J. M. BARTLETT, Chemist in Charge of Fertilizer Analysis

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The law regulating the sale of commercial fertilizers in this State calls for two bulletins each year. The first of these contains the analyses of the samples received from the manufacturer, guaranteed to represent, within reasonable limits, the goods to be placed upon the market later. The second bulletin contains the analyses of the samples collected in the open market by a representative of the Station.

The figures which are given as the percentages of valuable ingredients guaranteed by the manufacturers are the minimum percentages of the guarantee. If, for instance, the guarantee is 2 to 3 per cent of nitrogen, it is evident that the dealer cannot be held to have agreed to furnish more than 2 per cent and so this percentage is taken as actual guarantee. The figures under the head of "found" are those showing the actual composition of the samples.

In 1894 this Station stopped printing trade valuations. The chief reason for so doing was that *commercial* values are not the same as *agricultural* values. Trade values are determined by market conditions, the agricultural value is measured by the increase of crop. Printing trade valuations increases the tendency, already far too strong, to purchase fertilizers on the *ton* basis without regard to the content or form of plant food. The agricultural value of a fertilizer depends upon the amount and form of nitrogen, phosphoric acid and potash it contains and the use to which it is to be put. The purchase of a fertilizer is really the purchase of one or more of these ingredients, and the thing of first importance is not the trade value of a ton, but the kinds and pounds of plant food contained in a ton.

## DESCRIPTIVE LIST OF MANUFACTURERS' SAMPLES, 1900.

Station number.	Manufacturer, place of business and brand.
	HIRAM BLANCHARD, EASTPORT, ME.
2319	Blanchard's Fish, Bone and Potash.....
2320	Blanchard's Grass and Grain Fertilizer .....
2115	Blanchard's Ground Fish Scrap No. 2 .....
	THE BOWKER FERTILIZER CO., BOSTON, MASS.
1852	Bowker's Corn Phosphate .....
2370	Bowker's Early Potato Manure .....
1251	Bowker's Farm and Garden Phosphate .....
2371	Bowker's Fresh Ground Bone Phosphate .....
1248	Bowker's Hill and Drill Phosphate .....
2372	Bowker's Potash Bone.....
1249	Bowker's Potato and Vegetable Fertilizer .....
1389	Bowker's Potato and Vegetable Phosphate .....
1390	Bowker's Six Per Cent Potato Fertilizer .....
1250	Bowker's Square Brand Bone and Potash .....
1866	Bowker's Staple Phosphate or Three Per Cent Fertilizer .....
2374	Bowker's Sure Crop Phosphate.....
1588	Bowker's Ten Per Cent Manure .....
1871	Gloucester Fish and Potash .....
1580	Stockbridge Corn and Grain Manure .....
1870	Stockbridge Pea and Bean Manure .....
1388	Stockbridge Potato and Vegetable Manure .....
2373	Stockbridge Seeding Down Manure .....
	BRADLEY FERTILIZER CO., BOSTON, MASS.
2112	Bradley's Complete Manure for Potatoes and Vegetables .....
2321	Bradley's Corn Phosphate .....
2111	Bradley's Eureka Fertilizer .....
2322	Bradley's Niagara Phosphate .....
2323	Bradley's Potato Fertilizer .....
2324	Bradley's Potato Manure .....
2325	Bradley's X. L. Superphosphate.....
	CLEVELAND DRYER CO., BOSTON, MASS.
1607	Cleveland Fertilizer for All Crops .....
2329	Cleveland Potato Phosphate .....
2109	Cleveland Seeding Down Fertilizer .....
2330	Cleveland Superphosphate .....
	E. FRANK COE CO., NEW YORK, N. Y.
2117	E. Frank Coe's Columbia Corn Fertilizer .....
2118	E. Frank Coe's Columbian Potato Fertilizer .....
2119	E. Frank Coe's Excelsior Potato Fertilizer .....
1617	E. Frank Coe's Grass and Grain Special .....
2116	E. Frank Coe's High Grade Ammoniated Bone Superphosphate .....
1884	E. Frank Coe's High Grade Potato Fertilizer .....
2388	E. Frank Coe's New Englander Corn Fertilizer .....
2141	E. Frank Coe's New Englander Potato Fertilizer .....
2120	E. Frank Coe's Prize Brand Grain and Grass Fertilizer .....
2389	E. Frank Coe's Red Brand Excelsior Guano .....
1405	E. Frank Coe's Special Potato Fertilizer .....
2121	E. Frank Coe's Standard Grade Ammoniated Bone Superphosphate .....

## ANALYSES OF MANUFACTURERS' SAMPLES, 1900.

Station number.	NITROGEN.				PHOSPHORIC ACID.								POTASH.	
	Soluble in water.	Insoluble in water.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.	
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.			
	%	%	%	%	%	%	%	%	%	%	%	%	%	
2319	1.08	2.28	3.36	3.00	.16	2.68	.98	2.84	3.00	3.82	4.00	3.45	3.00	
2320	.62	2.64	3.26	4.47	.16	2.98	.41	3.14	3.00	3.55	4.28	2.08	2.00	
2115	.49	3.64	4.13	4.00	....	3.39	.89	3.39	3.00	4.43	4.00	1.44	1.00	
1852	....	....	1.88	1.60	....	....	2.77	8.59	7.00	11.36	9.00	2.26	2.00	
2370	1.46	1.54	3.00	3.00	4.21	3.52	2.23	7.73	7.00	9.96	9.00	7.06	7.00	
1251	....	....	1.86	1.50	5.27	3.01	1.79	8.28	8.00	10.07	10.00	2.21	2.00	
2371	.77	1.80	2.57	2.25	....	....	....	....	....	25.39	24.00	....	....	
1248	....	....	2.60	2.25	7.36	1.87	3.08	9.23	9.00	12.31	12.00	2.52	2.00	
2372	.53	.36	.89	.75	2.54	4.80	1.91	7.34	6.00	9.25	8.00	2.70	2.00	
1249	....	....	2.54	2.25	3.79	2.54	4.31	6.33	8.00	10.64	10.00	4.42	4.00	
1389	....	....	1.77	1.50	3.83	3.50	5.40	7.23	8.00	12.73	10.00	2.34	2.00	
1390	....	....	1.01	.75	3.93	3.92	3.86	7.81	7.00	11.67	10.00	6.38	6.00	
1250	....	....	1.79	1.50	....	6.40	7.19	6.40	6.00	13.59	12.00	2.21	2.00	
1866	....	....	1.00	.75	....	....	3.18	8.68	8.00	11.86	10.00	3.65	3.00	
2374	.29	.56	.79	.75	6.36	3.70	2.23	10.06	9.00	12.29	11.00	2.30	2.00	
1588	....	....	1.15	.75	1.30	5.17	3.61	6.47	6.00	10.08	8.00	10.98	10.00	
1871	....	....	.97	.75	....	....	4.86	6.58	6.00	11.44	9.00	1.76	1.00	
1580	....	....	3.33	3.00	6.78	1.85	1.91	8.63	8.00	10.54	10.00	6.55	6.00	
1870	....	....	2.51	2.00	....	....	3.21	6.89	6.00	10.10	8.00	6.28	6.00	
1388	....	....	3.43	3.25	3.12	2.11	4.26	5.25	6.00	9.49	7.00	9.76	10.00	
2373	.92	1.26	2.18	2.50	5.22	3.33	1.94	8.55	6.00	10.49	10.00	10.50	10.00	
2112	1.06	2.40	3.46	4.00	5.36	3.32	1.51	8.68	8.00	10.19	9.00	6.91	7.00	
2321	.66	1.42	2.08	2.50	7.05	2.55	2.56	9.60	8.00	12.16	10.00	2.01	1.50	
2111	.11	1.06	1.17	1.25	5.93	2.35	1.55	8.28	8.00	9.83	9.00	2.32	2.00	
2322	.40	.64	1.04	1.00	5.41	3.15	1.38	8.56	7.00	9.94	8.00	1.49	1.08	
2323	.77	1.22	1.99	2.50	5.74	4.74	2.54	10.48	8.00	13.02	10.00	3.17	3.00	
2324	.81	1.58	2.39	3.00	2.89	3.80	3.18	6.69	6.00	9.87	8.00	5.15	5.00	
2325	1.10	1.36	2.46	3.00	6.74	3.16	1.80	9.90	9.00	11.70	11.00	2.68	2.00	
1607	....	....	1.48	1.03	6.71	2.16	2.35	8.87	8.00	11.22	9.00	2.42	2.00	
2329	.62	1.34	1.96	2.05	5.95	3.99	2.74	9.94	8.00	12.68	10.00	3.03	3.00	
2109	.11	1.06	1.17	1.03	5.79	2.89	1.27	8.68	8.00	9.95	9.00	2.20	2.00	
2330	.66	1.40	2.06	2.03	7.17	2.35	2.62	9.52	8.00	12.14	9.00	2.03	1.50	
2117	.28	1.22	1.50	1.23	5.97	2.86	2.67	8.83	8.50	11.50	10.50	2.94	2.50	
2118	.25	1.19	1.44	1.20	5.85	2.97	2.60	8.82	8.50	11.45	10.00	2.75	2.50	
2119	.65	2.02	2.67	2.50	6.14	1.34	1.27	7.48	7.00	8.75	9.00	9.91	8.00	
1617	....	....	2.83	.80	7.88	2.96	3.63	10.84	8.50	14.47	10.00	1.21	1.50	
2116	....	....	1.68	1.85	5.97	2.62	2.50	8.59	9.00	11.42	11.00	2.90	2.50	
1884	....	....	2.50	2.40	....	....	1.29	7.71	7.00	9.00	8.00	7.86	6.50	
2388	1.76	1.82	3.60	.80	5.88	1.86	1.44	7.71	7.50	9.11	....	8.99	3.00	
2141	.20	.95	1.15	.80	7.77	2.98	1.96	10.75	7.50	12.71	9.00	3.46	3.00	
2120	....	....	....	....	12.30	2.57	.47	14.87	10.50	15.34	12.00	.67	2.00	
2389	.88	.40	1.28	3.40	6.94	2.33	2.40	9.27	9.00	11.76	....	3.81	6.00	
1405	....	....	1.95	1.65	7.43	1.82	4.20	9.25	8.00	13.45	10.00	4.58	4.00	
2121	.27	1.26	1.53	1.20	6.32	2.33	2.87	8.65	8.00	11.52	10.00	2.45	2.25	

## DESCRIPTIVE LIST OF MANUFACTURERS' SAMPLES, 1900.

Station number.	Manufacturer, place of business and brand.
	CROCKER FERTILIZER AND CHEMICAL CO., BUFFALO, N. Y.
2331	Crocker's Ammoniated Corn Phosphate .....
2332	Crocker's Grass and Oats Fertilizer .....
2333	Crocker's New Rival Ammoniated Superphosphate .....
2334	Crocker's Potato, Hop and Tobacco Phosphate .....
2335	Crocker's Superior Fertilizer .....
	CUMBERLAND BONE PHOSPHATE CO., PORTLAND, ME.
2336	Cumberland Potato Fertilizer .....
1395	Cumberland Seeding Down Manure .....
2337	Cumberland Superphosphate .....
	CLARK'S COVE FERTILIZER CO., BOSTON, MASS.
2326	Bay State Fertilizer .....
2327	Bay State Fertilizer, G. G. ....
1219	Bay State Fertilizer for Seeding Down .....
2328	King Philip Alkaline Guano .....
	L. B. DARLING FERTILIZER CO., PAWTUCKET, R. I.
2376	Darling's Animal Fertilizer, G. Brand .....
2377	Darling's Blood, Bone and Potash .....
	GREAT EASTERN FERTILIZER CO., RUTLAND, VT.
1578	Great Eastern Dissolved Bone .....
1230	Great Eastern General Fertilizer .....
1231	Great Eastern Grass and Oats Fertilizer .....
2384	*Great Eastern Northern Corn Special .....
2383	*Great Eastern Potato Manure .....
	LOWELL FERTILIZER CO., BOSTON, MASS.
1874	Swift's Lowell Animal Fertilizer .....
1875	Swift's Lowell Bone Fertilizer .....
1876	Swift's Lowell Dissolved Bone and Potash .....
1879	Swift's Lowell Fruit and Vine Fertilizer .....
2386	Swift's Lowell Ground Bone .....
2387	Swift's Lowell Potato Manure .....
1877	Swift's Lowell Potato Phosphate .....
	LISTER'S AGRICULTURAL CHEMICAL WORKS, NEWARK, N. J.
2105	Lister's Seeding Down Fertilizer .....
2104	Lister's Special Potato Fertilizer .....
2103	Lister's Success Fertilizer .....
2102	Lister's U. S. Superphosphate .....
	NATIONAL FERTILIZER CO., BRIDGEPORT, CONN.
1885	Chittenden's Ammoniated Bone .....
1886	Chittenden's Complete Fertilizer .....
2385	Chittenden's Market Garden .....
	NEW ENGLAND FERTILIZER CO., BOSTON, MASS.
2378	New England Corn Phosphate .....
2379	New England Potato Fertilizer .....
	SAMUEL G. OTIS, HALLOWELL, ME.
2369	Otis Potato Fertilizer .....
2380	Otis Seeding Down Fertilizer .....
2368	Otis Superphosphate .....
	PACIFIC GUANO CO., BOSTON, MASS.
2338	Pacific Guano Company's Grass and Grain Fertilizer .....
2339	Pacific Guano Company's Nobsque Guano .....
2340	Pacific Guano Company's Potato Special .....
2341	Pacific Guano Company's Soluble Pacific Guano .....
	PACKER'S UNION FERTILIZER CO., NEW YORK, N. Y.
2342	Packer's Union Animal Corn Fertilizer .....
2343	Packer's Union Economical Vegetable Guano .....
2344	Packer's Union High Grade Potato Manure .....
2345	Packer's Union Universal Fertilizer .....
1619	Packer's Union Wheat, Oats and Clover Fertilizer .....

\* Not yet analyzed.

## ANALYSES OF MANUFACTURERS' SAMPLES, 1900.

Station number.	NITROGEN.				PHOSPHORIC ACID.								POTASH.	
	Soluble in water.	Insoluble in water.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.	
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.			
	%	%	%	%	%	%	%	%	%	%	%	%	%	
2331	.26	2.06	2.32	2.05	4.52	3.65	3.87	8.17	8.00	12.04	9.00	2.26	1.50	
2332	.....	.18	.18	.....	7.54	4.28	1.79	11.82	11.00	13.61	12.00	2.03	2.00	
2333	.23	1.14	1.37	1.03	4.82	3.70	2.47	8.52	8.00	10.99	9.00	2.12	2.00	
2334	.28	1.98	2.26	2.05	4.31	3.68	3.74	7.99	8.00	11.73	9.00	3.65	3.25	
2335	.10	.96	1.06	.82	5.19	3.87	2.11	9.06	8.00	11.17	9.00	2.12	2.00	
2336	.72	1.34	2.06	2.06	6.13	4.17	2.33	10.30	8.00	12.63	9.00	3.38	3.00	
1395	.....	.....	1.10	1.03	5.82	1.98	2.11	7.80	8.00	9.91	10.00	2.93	2.00	
2337	.56	1.38	1.94	2.06	7.01	2.38	2.55	9.39	8.00	11.94	9.00	2.35	1.5	
2326	1.14	1.32	2.46	2.47	7.26	3.08	1.80	10.34	9.00	12.14	10.00	2.35	2.00	
2327	.62	1.40	2.02	2.06	7.21	2.42	2.36	9.63	8.00	11.99	9.00	1.95	1.50	
1219	.....	.....	2.33	1.03	7.18	2.55	1.89	9.73	8.00	11.62	10.00	2.59	2.00	
2328	.43	.68	1.11	1.03	5.71	2.67	1.47	8.38	8.00	9.85	9.00	2.12	2.00	
2376	.77	1.32	2.09	2.06	5.49	4.68	2.41	10.17	8.00	12.58	9.00	3.22	3.00	
2377	.....	4.21	4.21	4.12	6.47	1.27	.26	7.74	7.00	8.00	8.00	9.01	7.00	
1578	.....	.....	.....	.....	9.27	5.86	1.36	15.13	14.00	16.49	14.00	.....	.....	
1239	.....	.....	1.10	.82	.69	9.25	2.26	9.94	8.00	12.20	8.00	4.72	4.00	
1231	.....	.....	.....	.....	4.11	6.88	4.08	10.99	11.00	15.07	11.00	2.15	2.00	
2384	.42	1.84	2.26	2.06	5.02	4.60	2.35	9.62	8.00	11.97	8.00	2.26	1.50	
2383	.96	1.20	2.16	2.06	4.67	3.92	2.64	8.59	8.00	11.23	8.00	5.33	3.25	
1874	.....	.....	2.85	2.46	.....	.....	1.01	16.38	9.00	11.39	10.00	4.10	4.00	
1875	.....	.....	2.06	1.64	.....	.....	1.31	8.27	8.00	9.58	9.00	3.56	3.00	
1876	.....	.....	1.90	1.64	.....	.....	1.73	9.33	9.00	11.06	10.00	2.45	2.00	
1879	.....	.....	3.69	3.29	.....	.....	.96	7.72	7.00	8.68	8.00	6.44	6.00	
2386	.....	.....	2.38	2.46	.....	.....	.....	.....	5.00	27.24	22.90	.....	.....	
2387	.78	.94	1.72	1.64	3.33	4.47	1.35	7.80	7.00	9.15	8.00	4.52	4.00	
1877	.....	.....	2.61	2.46	.....	.....	1.08	9.41	8.00	10.49	9.00	6.96	6.00	
2105	.....	.....	.90	.62	7.58	2.64	2.47	10.22	10.00	12.69	11.00	1.06	1.00	
2104	.25	1.46	1.71	1.65	5.87	2.52	2.38	8.39	8.00	10.77	9.00	2.94	3.00	
2103	.27	1.22	1.49	1.24	7.23	2.33	2.43	9.56	9.50	11.99	11.50	2.06	2.00	
2102	.19	1.35	1.54	1.32	5.09	2.34	2.03	7.43	7.00	9.46	8.00	2.39	2.00	
1885	..	.....	2.42	1.60	.....	.....	1.61	9.72	9.00	11.33	10.00	3.69	2.00	
1886	.....	.....	3.79	3.30	.....	.....	1.33	9.35	8.00	10.68	10.00	6.31	6.00	
2385	1.22	1.00	2.22	2.47	4.45	2.60	2.48	7.05	6.00	9.53	8.00	5.94	5.00	
2378	.76	1.02	1.78	1.64	3.85	4.93	1.33	8.78	8.00	10.11	9.00	3.23	3.00	
2379	.88	.88	1.76	1.64	3.46	4.89	.98	8.35	7.00	9.33	8.00	4.28	4.00	
2369	.77	1.22	1.99	2.06	5.68	5.03	2.42	10.71	8.00	13.13	10.00	3.20	3.00	
2380	.49	.62	1.11	1.25	5.46	2.89	1.35	8.35	8.00	9.70	10.00	1.56	2.00	
2368	.68	1.38	2.06	2.06	6.94	2.92	2.43	9.86	8.00	12.29	10.00	2.16	1.50	
2338	.42	.64	1.06	.82	5.46	3.01	1.43	8.47	7.00	9.90	8.00	2.99	1.00	
2339	.40	.66	1.06	1.03	5.52	2.66	1.63	8.18	8.00	9.81	9.00	1.97	2.00	
2340	.76	1.34	2.10	2.05	5.69	4.27	2.70	9.96	8.00	12.66	9.00	3.15	3.00	
2341	.52	1.46	1.98	2.06	6.72	2.72	2.32	9.44	8.00	11.76	9.00	1.91	1.50	
2342	.31	2.10	2.41	2.47	5.64	3.22	3.46	8.86	9.00	12.32	10.00	1.91	2.00	
2343	.26	1.42	1.68	1.25	4.65	2.55	2.15	7.20	6.00	9.35	7.00	3.59	3.00	
2344	.96	1.10	2.06	2.06	4.85	3.16	1.85	8.01	8.00	9.86	9.00	2.26	6.00	
2345	.25	.96	1.21	.8235	6.05	3.22	1.46	9.27	8.00	10.73	9.00	5.04	4.00	
1619	.....	.....	.25	.....	.....	.....	1.20	10.92	11.00	12.12	12.00	2.39	2.00	

## DESCRIPTIVE LIST OF MANUFACTURERS' SAMPLES, 1900.

Station number.	Manufacturer, place of business and brand.
	PARMENTER & POLSEY FERTILIZER CO., PEABODY, MASS.
2124	Parmenter & Polsey Fertilizer Co.'s Special Potato Fertilizer.....
2123	Plymouth Rock Brand.....
2346	"P. and P." Potato Fertilizer .....
2125	Star Brand Superphosphate.....
	EDWIN J. PHILBRICK, AUGUSTA, ME.
1888	Philbrick's Fertilizer .....
	PORTLAND RENDERING CO., PORTLAND, ME.
1616	Portland Rendering Co.'s Bone Tankage....
	THE QUINNIPIAC CO., BOSTON, MASS.
2347	Quinnipiac Corn Manure.....
2348	Quinnipiac Phosphate.....
2349	Quinnipiac Potato Manure.....
2350	Quinnipiac Potato Phosphate.....
2351	Quinnipiac Seeding Down Manure.....
	READ FERTILIZER CO., NEW YORK, N. Y.
2352	Read's Potato Manure .....
1396	Read's Practical Potato Special.....
1397	Read's Standard Fertilizer .....
2354	Read's Sure Catch Fertilizer.....
2355	Read's Vegetable and Vine Fertilizer .....
2353	Sampson Fertilizer.....
	THE RUSSIA CEMENT CO., GLOUCESTER, MASS.
1410	Essex Complete Manure for Corn, Grain and Grass.....
1411	Essex Complete Manure for Potatoes, Roots and Vegetables.....
2106	Essex Corn Fertilizer. ....
2108	Essex Potato Fertilizer .....
1568	Essex XXX Fish and Potash.....
1891	Maine State Grange Chemicals.....
1892	Maine State Grange Potato Manure .....
2107	Maine State Grange Seeding Down Fertilizer ....
	SAGADAHOC FERTILIZER CO., BOWDOINHAM, ME.
2356	Dirigo Fertilizer.....
2357	Merrymeeting Superphosphate .....
2358	Sagadahoc Special Potato Fertilizer.....
2359	Sagadahoc Superphosphate.....
2360	Yankee Fertilizer.....
	STANDARD FERTILIZER CO., BOSTON, MASS.
1414	Standard "A" Brand .....
2361	Standard Fertilizer.....
2362	Standard Guano .....
2363	Standard Special for Potatoes.....
	JOHN WATSON, HOULTON, ME.
2375	Watson's Improved High Grade Potato Manure .....
	WILLIAMS & CLARK FERTILIZER CO., BOSTON, MASS.
2364	Americus Ammoniated Bone Superphosphate ..
2365	Americus Corn Phosphate .....
2366	Americus Potato Manure.....
1236	Royal Bone Phosphate for All Crops.....
2367	Williams & Clark's Potato Phosphate .....

Note.—While this bulletin was in press there was received from the Provincial Chemical Fertilizer Co., of St. John, N. B., the manufacturer's certificate for a Potato Phosphate, having the following guaranteed composition: Nitrogen, 2.88 per cent; available phosphoric acid, 8.00 per cent; potash, 6.50 per cent. The sample forwarded was received too late to allow the analysis to be inserted here.

## ANALYSES OF MANUFACTURERS' SAMPLES, 1900.

Station number.	NITROGEN.				PHOSPHORIC ACID.								POTASH.	
	Soluble in water.	Insoluble in water.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.	
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.			
2124	% 1.69	% 1.29	% 2.98	% 3.29	% 4.21	% 4.27	% 1.29	% 8.48	% 8.00	% 9.77	% 9.00	% 7.41	% 7.00	
2123	.21	2.08	2.29	2.47	3.81	4.21	1.38	8.02	8.00	9.40	9.00	4.19	4.00	
2346	1.00	.84	1.84	1.64	2.36	5.15	.99	7.51	6.00	8.50	7.00	6.91	6.00	
2125	1.01	.79	1.80	1.64	3.80	3.54	1.15	7.34	7.00	8.49	8.00	2.60	2.50	
1888	.38	1.65	2.03	2.00	2.00	5.19	1.74	7.19	7.00	8.93	9.00	5.58	5.00	
1616	.....	.....	4.27	4.54	.....	7.34	12.06	7.34	.....	19.40	16.65	.....	.....	
2347	.67	1.38	2.05	2.06	6.69	2.63	2.41	9.32	8.00	11.73	9.00	1.95	1.50	
2348	1.20	1.26	2.46	2.47	6.77	3.06	1.97	9.83	9.00	11.80	10.00	2.43	2.00	
2349	1.03	1.50	2.53	2.47	2.55	4.03	3.06	6.58	6.00	9.64	7.00	5.15	5.00	
2350	.74	1.30	2.04	2.06	5.61	4.71	2.36	10.32	8.00	12.68	9.00	3.34	3.00	
2351	.39	.64	1.03	1.03	5.44	3.14	1.46	8.85	8.00	10.04	9.00	2.61	2.00	
2352	.42	2.28	2.70	2.47	4.59	1.89	1.25	6.48	6.00	7.73	7.00	10.94	10.00	
1396	.....	.....	1.20	.83	3.39	1.55	.54	4.94	4.00	5.48	5.00	8.35	8.00	
1397	.....	.....	1.15	.83	6.50	1.73	.92	8.23	8.00	9.15	9.00	4.33	4.00	
2354	.....	.20	.20	.....	4.64	5.17	1.58	9.81	10.00	11.39	11.00	1.91	2.00	
2355	.32	1.80	2.12	2.05	5.94	2.25	1.38	8.29	8.00	9.67	9.00	6.35	6.00	
2353	.52	1.40	1.92	2.05	6.40	2.35	1.89	8.75	8.00	10.64	9.00	2.93	3.00	
1410	.....	.....	4.00	3.70	3.02	6.39	2.51	9.41	7.60	11.92	9.50	10.52	9.50	
1411	.....	.....	3.96	3.70	2.60	5.54	2.84	8.14	7.00	10.98	9.00	9.18	8.50	
2106	.52	1.72	2.24	2.00	5.31	4.03	4.14	9.34	9.00	13.48	10.50	3.33	3.00	
2108	.63	1.55	2.18	2.00	5.50	4.18	4.08	9.68	9.00	13.76	10.50	5.57	5.00	
1568	.....	.....	2.68	2.10	8.00	2.63	2.56	10.63	9.00	13.19	12.00	2.75	2.25	
1891	.82	1.58	2.40	2.50	2.45	5.71	3.89	8.16	8.00	12.05	12.00	4.72	4.00	
1892	.....	1.02	1.02	1.50	1.34	7.11	3.67	8.45	9.00	12.12	12.00	12.43	12.00	
2167	.....	1.91	1.91	1.50	3.19	4.24	6.36	7.43	7.00	13.79	13.00	5.69	5.50	
2356	.31	1.58	1.89	1.50	2.20	2.71	5.48	4.91	3.50	10.39	9.00	3.74	3.75	
2357	.22	1.16	1.38	1.20	2.81	3.80	3.36	6.61	5.00	9.97	9.00	2.84	2.00	
2358	1.16	.60	1.76	2.40	6.05	2.86	.73	8.91	6.50	9.64	9.50	7.89	7.00	
2359	1.01	1.12	2.13	2.05	3.77	4.22	3.08	7.99	6.50	11.07	10.00	5.66	4.00	
2360	.46	.36	.76	.40	1.83	3.73	.63	5.56	5.50	6.19	7.00	4.54	1.50	
1414	....	.....	1.33	.82	4.84	3.08	1.96	7.92	7.00	9.88	9.00	1.71	1.00	
2361	.60	1.42	2.02	2.06	6.82	2.43	2.55	9.25	8.00	11.80	9.00	2.01	1.50	
2362	.37	.70	1.07	1.03	5.31	3.03	1.44	8.34	8.00	9.78	9.00	2.10	2.00	
2363	.82	1.20	2.02	2.05	5.65	5.16	2.40	10.81	8.00	13.21	9.00	2.93	3.00	
2375	.93	1.18	2.11	3.25	1.98	2.79	1.88	4.77	6.00	6.65	7.00	7.03	5.00	
2364	.95	1.32	2.27	2.47	6.72	3.08	1.94	9.80	9.00	11.74	10.00	2.35	2.00	
2365	.56	1.42	1.98	2.06	6.75	2.85	2.29	9.60	8.00	11.89	9.00	1.95	1.50	
2366	.64	1.32	1.96	2.06	5.52	4.89	2.23	10.41	8.00	12.64	9.00	3.03	3.00	
1236	.....	.....	1.26	1.03	6.20	3.11	2.23	9.30	8.00	11.54	9.00	2.26	2.00	
2367	1.02	1.50	2.52	2.47	2.56	4.07	2.94	6.63	6.00	9.57	7.00	5.46	5.00	

## THE CHIEF PROVISIONS OF THE FERTILIZER LAW APPLYING TO MANUFACTURERS, IMPORTERS AND DEALERS.

The law for the regulation of the sale and analyses of commercial fertilizers makes the following requirements upon manufacturers, importers or dealers who propose to sell or offer for sale commercial fertilizers in the State:

1. *The Brand.* Each package shall bear, conspicuously printed, the following statements:

The number of net pounds contained in each package.

The name or trade mark under which it is sold.

The name of the manufacturer or shipper.

The place of manufacture.

The place of business of manufacturer or shipper.

The percentage of nitrogen or its equivalent in ammonia.

The percentage of potash soluble in water.

The percentage of phosphoric acid in available form.

The percentage of total phosphoric acid.

2. *The Certificate.* There shall be filed annually between Nov. 15 and Dec. 15 with the Director of the Station a certificate containing an accurate statement of the brand. This certificate applies to the next succeeding calendar year. (Blanks for this purpose will be furnished on application to the Station.)

3. *Manufacturer's Samples.* There shall be deposited annually, unless excused by the Director under certain conditions, a sample of fertilizer, with an accompanying affidavit that this sample "corresponds within reasonable limits to the fertilizer which it represents."

4. *Analysis fee.* For each brand of fertilizer sold or offered for sale in the state there shall be paid annually to the Director of the Station "an analysis fee as follows: Ten dollars for the phosphoric acid and five dollars each for the nitrogen and potash, contained or said to be contained in the fertilizer."

5. *The license.* Upon receipt of the fee, the certificate and the sample (if required), the Director of the Station "shall issue a certificate of compliance."

[The full text of the law will be sent to those asking for it.]

[The papers which follow were prepared by Professor Harvey in the fall of 1899 before his illness, and were in press at the time of his death. C. D. W.]

## NOTES ON INSECTS OF THE YEAR 1899.

F. L. HARVEY.

The year has been somewhat remarkable on account of the great abundance of several species of plant lice, leaf rollers and bud moths, and the great number of forest tent caterpillars. The important species of the year are considered below in notes or in greater length under special titles. The less important forms are merely mentioned in the table of insects (page 40) examined in 1899.

CHINCH BUG. (*Blissus leucopterus*). The chinch bug is reported as being quite abundant on the farms of Mr. Chas. Evans and Mr. W. L. Howe and others in the intervale lands near Fryeburg. It attacks herdsgrass, eating the bulbous bases of the stems after haying, requiring reseeding. Figured on page III of Report of this Station for 1894.

DESTRUCTIVE PEA LOUSE. (*Nectarophora destructor*, Johnson). This new species of pea aphid was very abundant in Maine the past season, doing much damage to garden and field peas.

CUCUMBER PLANT LICE. Plant lice were very abundant on squashes and cucumbers the past season, doing much damage. The common species, *Aphis gossypii*, was responsible for most of the injury, though another species common on rough amaranthus was also found on squashes.

THE CORN LOUSE, (*Aphis maidis*), was abundant on sweet corn in some parts of the State.

DOBSON FLY. HELGRAMITE. (*Corydalis cornuta*). The nymphs as well as the flies of this species have been received several times for examination, indicating that the species is abundant in Maine waters. The nymph is the well known bass bait. The nymphs and flies are both large and attract attention. The former is the terror of smaller water insects, while the latter is conspicuous by its large head, powerful jaws, and long coarsely nerved wings.

THE LESSER LEAF ROLLER. (*Teras minuta*). The specimens examined were bred from apple foliage. It also attacks cranberries and huckleberries and is one of the fire worms of cranberry bogs. It is considered in detail in Bulletin 56 of this Station.

THE OBLIQUE-BANDED LEAF ROLLER. (*Cacæcia rosana*). This was bred from the foliage of apple trees sent by Mr. Chas. S. Pope, Manchester. It is a new apple insect in Maine, at least we have not seen it before on apples. We reared the moths from currant leaves in 1894.

AMERICAN ELM PLANT LOUSE. (*Schizoneura americana*). This insect was abundant about Orono, Bangor and Augusta.



Work of the elm plant louse.



Work of the eye-spotted bud moth.

EYE-SPOTTED BUD MOTH. (*Tmetocera ocellana*). The moth was bred abundantly from apple twigs. It has done much damage to the flower and leaf buds and foliage of apple trees the past season. It is considered in detail in Bulletin 56 of this Station.

CHERRY TREE UGLY-NEST. (*Cacæcia cerasivorana*). This is a new apple insect for Maine. It was reported, also, as feeding upon choke cherry, its more common food plant, and upon

hazelnut. The conspicuous nests are common on choke cherry bushes in Maine, but uncommon on apples.

APPLE BUCCULATRIX. (*Bucculatrix pomifoliella*). The cocoons of this insect were received from Mr. L. F. Abbott of the Lewiston Journal, who reports them abundant in Lewiston. He also reports having seen them at Wilton, Jay and Livermore. For detailed account see Bulletin 56 of this Station.

THE AMERICAN TIGER MOTH. (*Arctia americana*). This was found on beets in a garden. It is not a common species in Maine. The fore wings are brown with white bands, the hind wings orange with round black spots. The moth has nearly three inches spread of wing. The beet belongs to the same family as the pigweeds (*Amaranthus*) upon which some tiger moths feed.

SPHINX MOTHS were quite abundant the past season. The elm sphinx was abundant on elms; the grape sphinx (*Philampelus achemon*) reported on grapes; the twin-spotted sphinx on apple. These insects are not usually abundant but the larvæ are capable of doing much damage on account of their large size and voracity.

THE STALK BORER. (*Gortyna nitela*). Specimens of strawberries containing the half grown larvæ of the above species were received from Buxton. The caterpillars were entirely buried in the berries. This habit is not new to entomologists, but so far as we know has never been observed before in this State. It has been detected boring into potato vines in Maine.

The usual number of specimens of *Cecropia*, *Promethea* and *Polyphemus* moths were reported. All were found in the cocoon or larval form upon apple trees. *Cecropia* was also reported feeding on plums.

THE VELLEDA LAPPET MOTH, though not an abundant insect in Maine, continues to be reported as doing some injury to plums. The books give the apple, poplar and other plants as its most common food. It is called the lappet moth because the caterpillar has a flat lobe or lappet on the sides of each segment. These lobes are provided with long hairs, giving the caterpillar a fringed appearance. When at rest the larvæ lie close to the branches and are hard to find.

THE FOREST TENT CATERPILLAR was very troublesome the past season in southern and western Maine. Many articles

appeared in the papers of the State regarding them. The Station issued a newspaper bulletin on the insect and the writer prepared an article for a bulletin issued by the State Board of Agriculture. It will be impossible to treat this insect in the forests, but an effort ought to be made to prevent its ravages upon ornamental and orchard trees.

THE FALL CANCKER WORM, though reported from the center of the State, did not do great damage the past season and has become scarce about Orono.

THE MONARCH BUTTERFLY. (*Anosia plexippus*). This was unusually abundant the past season in the center of the State. The pale green chrysalids with golden spots on them are very beautiful objects and sure to attract attention. This large brown butterfly has black-veined wings on the black borders of which are many white spots. The larvæ feed on the milkweed. It is believed that the species dies out each season in the northern states and that the butterflies migrate from the south each spring. We have seen masses of this species as big as a bushel basket clinging together on the branches of a tree.

THE MOURNING CLOAK BUTTERFLY was exceedingly abundant the past season. It is a very bad elm tree insect, doing much damage to the shade trees in villages and cities. It is described in Experiment Station Report, 1888, p. 187.

THE DRONE FLY. (*Eristalis tenax*). This species was reported as being found about bee hives. These flies feed upon pollen and honey. They may have been attracted to the hives by the odor of the honey, but they would not venture into the hive and could do no harm.

ANTHOMYIID FLIES, probably *Pegomyia vicina*, were reported as doing much damage to the beet leaves in gardens. The larvæ of these flies work between the upper and under surface of the leaves, eating the leaf pulp and leaving whitish trails, not only injuring their functions but rendering them unsuitable for greens.

THE CURRANT FRUIT FLY. (*Epochra canadensis*). This species which has done so much injury about Orono was reported from Augusta, the past season. It attacks the fruit of the currant, causing it to turn red early, and drop prematurely. See Experiment Station Report, 1895, p. III.

THE BUFFALO CARPET BEETLE has been reported the past season from seven localities, representing every section of the State. For a consideration of this insect see Experiment Station Report, 1894, p. 115.

THE STRIPED SAP BEETLE. (*Ips fasciatus*). The last of June the following letter accompanied by specimens was received from Mrs. J. K. Garland, Eden, Maine: "I send you an insect that is killing my locust trees. It works on the trunk of the tree boring under the bark. In ten days it has apparently killed one tree and is attacking others. Is there anything that will destroy them? Will they be likely to attack maples and elms?"

The specimens received were the above species, an insect that has never been accused of more serious depredations than sucking the exuding sap from wounds on trees produced by mechanical injury, or insect depredations. Although we did not see the trees we feel sure they were suffering from attacks of borers and the sap beetles were there to feed upon the sap exuding from the borings.

THE MAY BEETLE continues to do damage in grass lands. The large white grubs of this species are the larvæ of the well known June bug. They feed upon the roots of grass and other plants, often doing great damage.

THE CHERRY LEAF BEETLE. (*Adimonia cavicollis*). This beetle was reported as doing much damage to the foliage of cherry trees. The species is common about Orono. It is reddish brown in color and about three-sixteenths of an inch long.

BEAN WEEVILS were reported as feeding upon stored beans. This pest seems to be widely distributed in Maine.

LARRID BEES. Last September we received a box of specimens from Mr. F. A. Campbell of Cherryfield and the next day specimens of the same insect from Mr. B. F. Grace of West Harrington. Mr. Campbell says his specimens "were dug from a gravelly, loamy hillock in a pasture. They have been known in the locality for three years. Over an area of 100 feet by 30 feet the ground is completely perforated with small holes the size of a pea and with a little earth around the entrance. In the middle of the day when it is sunny it is said they swarm over the hillock in great numbers making a noise with their wings that can be heard several hundred feet in the woods which surround the hillock. They are supposed to be Italian bees by some, but

if so, their habits are different from what I supposed. Some would like to dig for a ton of honey, but we shall not have them disturbed until we hear from you." Mr. Grace confirms the above account. The specimens sent were land bees and were accompanied by cells filled with *bee bread*, the pollen of plants, probably stored as food for the young bees. The larrids usually store their burrows with grasshoppers and related insects and are beneficial. The bee bread in this case had the smell of old cheese. There are fully fifty species of these sand bees in the United States and Canada, found mostly in the southwest. They do not make honey.

#### THE BROWN TAIL MOTH. (*Euproctis chrysorrhæa*).

F. L. HARVEY.

Specimens of the brown tail moth were taken the past season on Cut's Island, Kittery Point, Maine, by Mr. Charles Elliott Thaxter. He thinks they were imported from Cambridge, Mass., in household goods and that they have been on the island for two years and are probably established. This insect was reported from South Berwick, Maine, in 1897, but we were in doubt as we did not see specimens. (See Experiment Station Reports, 1897, p. 175 and 1898, p. 126). Mr. Thaxter kindly sent us a specimen taken by him as stated above. This dangerous insect enemy of the pear and many other trees, herbs and shrubs has to be added to our long list of insect pests.

*Distribution and History.* The brown tail moth is a native of the eastern continent, occurring in Europe, Northern Africa and Asia Minor. In the United States it was first called to the attention of the Gypsy Moth Commission of Massachusetts in May, 1897, at Somerville, Mass. Investigation showed that it had been in that region for at least three years. How it was introduced is not known. The first knowledge the Experiment Station had of its appearance in Maine was the following letter from Mr. Sessions of the Gypsy Moth Commission of Massachusetts:

"We are now making an inspection of the territory infested with our new imported pest, the brown tail moth (*Euproctis chrysorrhæa*). Our inspector in discharge of his duty called on Dr. Geo. E. Osgood of No. 283 Highland Avenue, Somerville.

The doctor is one of the reliable physicians of Somerville. His place is infested with the moth. He said that he saw the brown tail moth in South Berwick, Maine, while on his last summer's vacation, and was sure that it was identical with the Somerville pest. He also said that while he was in South Berwick he professionally treated two cases of poisoning by contact with the moth and that the symptoms of the patients were identical with those of his Somerville patients who had been poisoned by the brown tail moth. The premises in South Berwick are owned by the doctor's father-in-law, Andrew Whitehouse, 10 Goodwin St., South Berwick. I send you notice that you may take such measures as you think proper in the case."

We have no doubt but what Dr. Osgood's observations were correct, although we were not able to secure specimens at the time or since. Mr. Whitehouse wrote us in 1898 as follows: "I cannot find any specimens to send you. In the summer of 1897 my boy was badly poisoned by them. They were numerous on a woodbine on my premises and a few on my fruit trees. Last year I cut down the woodbine and burned it and have not seen any since." Mr. Whitehouse may have destroyed the colony, at least it is to be hoped that he did. He thinks they were imported on roses from Somerville, Mass.

Charles Elliott Thaxter writing under date of July 14, 1899, from Cut's Island, Kittery Point, Maine, says, "My father thinks that you would be interested to know that we have caught two brown tail moths this month, one on the wing July 3d, and another at rest July 12. My father thinks the cocoons or caterpillars must have been brought here from Cambridge two summers ago on our household goods, as brown tail moths were very plentiful about our house in Cambridge while we were packing. My father feels sure that they were not brought this year and thinks that they are likely to have become established on this island." We requested Mr. Thaxter to send us a Maine specimen of the moth and he did so. Food plants of the moth in Europe are the apple, pear, plum and rose of the rose family, and a number of forest trees. In this country it seems to prefer the pear but has been found feeding upon between thirty and forty herbs, shrubs or trees including many families, showing it to be a general feeder.

The following account of the life history of this insect is taken from a special bulletin issued July, 1897, by the Massachusetts Experiment Station.

#### DESCRIPTION.

"The eggs are laid in July, in masses of from 200 to 300, usually on the under side of the leaves, and are covered with the brown hairs from the end of the abdomen. They hatch in a short time and the young caterpillars feed during the rest of the season on the surface of the leaves, leaving in a few days only the skeleton. While still young they begin to make a regular dwelling in which they hibernate during the winter. This habitation is constructed at the ends of the twigs and is made by drawing together a few leaves, lining them with silk and surrounding them with a mass of silken threads. These tents are so firmly fastened to the twigs that they cannot be removed without using considerable force.

"Before the leaves begin to grow in the spring, the young caterpillars emerge from their winter retreat and often feed on the swelling buds. They reach their full growth in the early part of June and transform to pupæ. In a lot of about eighty, bred in confinement, the last one pupated June 18.

"The full grown caterpillars are from an inch and a quarter to an inch and three-quarters in length. The head is pale brown, mottled with dark brown, with reddish brown hairs scattered over the surface. The body is dark brown or black with numerous fine, dull orange or gray spots over the surface, most pronounced on the second, third and fourth segments. Long, reddish-brown, finely barbed hairs arise from all the tubercles, and white branching hairs arise from the upper side of the lateral tubercles on segments 4 to 12 inclusive. These white hairs form elongated white spots along each side and are one of the most striking characteristics of this caterpillar. The subdorsal and lateral tubercles on segments 4 to 12 inclusive are covered with fine short spines of uniform length. There is a vermillion red, retractile tubercle on the top of the tenth, and a similar one on the top of the eleventh segment.

"When the caterpillars are done feeding they change to pupæ among the leaves, two or more often transforming together, spinning an open cocoon of coarse silk. The pupæ are about three-fourths of an inch in length, dark brown in color, and with fine yellowish brown hairs scattered over the surface. In a short time the moths emerge from the cocoons and after mating lay their eggs.

"The males are pure white with a satin-like luster on the fore wings, a reddish brown tuft at the end of the abdomen and sometimes there are a few black dots on the fore-wings. The antennæ are white and fringed with pale yellowish hairs. They measure about an inch and a quarter between the tips of the expanded wings.

"The females are of the same color as the males, except that they have no black spots on the wings, the anal tuft is larger and lighter in color and the antennæ are shorter and have shorter fringes. Expanse of wings, about an inch and three-quarters."

#### HABITS OF THE CATERPILLARS.

The young caterpillars of the brown tail moth, after hibernating in the tents which they construct at the tip of the branches, emerge in the spring and feed downward towards the main branches and trunk, leaving the naked twigs bearing the gray tents at the ends, a conspicuous evidence of the presence of this insect. They eat the entire leaf except the midrib, and, in leaves having strong ribs, like those of the sycamore maple, all the larger ribs are left untouched. When the caterpillars are numerous they devour not only the buds, leaves and blossoms, but even the green fruit.

One of the most annoying features of this caterpillar is the painful irritation or nettling caused by the insects when coming in contact with the skin. The hairs of the caterpillar are brittle and easily become detached, and when they come in contact with the skin, produce a most intense irritation. From this cause many persons have suffered so severely as to require the aid of a physician. The invasion of houses by these insects is a common occurrence, and not unfrequently they make their way into the sleeping apartments.

## INSECTS EXAMINED IN 1899.

COMMON NAME.	TECHNICAL NAME.	LOCALITY.	REMARKS.
BRISTLE-TAIL .....	<i>Lepisma</i> .....	Riverside, .....	About in cupboards.
GRINCH BUG .....	<i>Blissus leucopterus</i> .....	Pryeburg .....	Quite bad in grass land.
SQUASH BUG .....	<i>Anasa tristis</i> .....	North Livermore, .....	On squash and pumpkin vines.
DOG-DAY HARVEST FLY .....	<i>Cicada thibron</i> .....	Ellot .....	Taken on apple limb making incisions.
PERNICOUS PEA APHIS .....	<i>Nectarophora destructor</i> .....	{ Orono, .....	On cultivated peas. Very abundant.
		{ Comebunkport, .....	
		{ Brunswick, .....	
		{ West Eden, .....	
		{ Belfast, .....	On cucumbers.
CUCUMBER PLANT LOUSE .....	<i>Aphis gossypii</i> .....	{ Orono, .....	
		{ Bangor, .....	Abundant on elms.
AMERICAN ELM PLANT LOUSE .....	<i>Schizoneura americana</i> .....	{ Augusta, .....	Common water insect used as bait for bass.
DOBSON FLY, HELIGRAMITE .....	<i>Corydalis cornuta</i> .....	{ Auburn, .....	
		{ Caldigah, .....	
THE LESSER LEAF ROLLER .....	<i>Pteris nivalis</i> .....	Manchester .....	Rolling foliage of apple trees.
THE OBLIQUE-BANDED LEAF ROLLER .....	<i>Ctenactis rosana</i> .....	Manchester .....	Attacking the foliage of apple trees.
EYE-SPOTTED BUD MOTH .....	<i>Tinctocera ocellana</i> .....	{ Manchester, .....	Destroying buds on apple trees.
		{ Augusta, .....	
CHERRY TREE UGLY-NEST .....	<i>Cacoxena cerasivorana</i> .....	Washburn .....	Feeding on apple, choke cherry and hazel lute.
APPLE BEGULATRYX .....	<i>Bucculatrix pomifoliella</i> .....	Lewiston .....	Specimens taken at Lewiston, Wilton, Livermore and Jay.
THE POTATO-STALK BORER .....	<i>Gortyna nitela</i> .....	Buxton .....	Boring fruits of the strawberry.
AMERICAN TIGER MOTH .....	<i>Arctia americana</i> .....	Gardner .....	On beets in garden.
ELM SPUNK .....	<i>Scythionia quadricornis</i> .....	{ Harmony, .....	On elms and on planks in garden.
		{ South Dover, .....	
HAWK MOTH, SPUNK MOTH .....	<i>Phthoropus achemon</i> .....	{ Gardner, .....	On grapes.
		{ North Livermore, .....	

THE TWIN-SPOTTED SPHINX .....	<i>Smerinthus geminatus</i> .....	Orono .....	A common apple insect.
ROSY DRYOCAMPA .....	<i>Dryocampa rubicunda</i> .....	Foxcroft .....	On clover.
CECROPIA EMPEROR MOTH .....	<i>Samia cecropia</i> .....	{ Lagrange .....	Plentiful on apples. One specimen on
* PROMETHEA MOTH .....	<i>Callosamia promethea</i> .....	{ Readfield .....	plum foliage.
		{ Kenduskeag .....	On apple trees.
POLYPHEMIS MOTH .....	<i>Teleda polyphemus</i> .....	Machias .....	
		{ Stroudwater .....	On apple trees.
		{ Hampden .....	
BROWNTAIL MOTH .....	<i>Euproctis chrysorrhæa</i> .....	{ Kittery .....	This dangerous moth has appeared in
		{ Cuts Island .....	Maine.
VELEDA LAPPET-MOTH .....	<i>Tolyte vellela</i> .....	Troy .....	On plum.
FOREST TENT CATERPILLAR .....	<i>Clistocampa dissidia</i> .....	All sections of State.	On shade trees in alarming numbers.
FALL CANKER WORM .....	<i>Alsophila pometaria</i> .....	Augusta .....	Larva on trees.
MONARCH BUTTERFLY .....	<i>Anosia plexippus</i> .....	{ Monmouth .....	Received in the chrysalid stage
		{ Cornish .....	mostly.
		{ North Anson .....	
		{ Fairfield Centre .....	
		{ Augusta .....	On elms.
		{ Livermore Falls .....	
MOURNING CLOAK BUTTERFLY .....	<i>Eumænassa antiopa</i> .....	{ Skowhegan .....	About bee hives. Not predaceous.
DRONE FLY .....	<i>Eristalis tenax</i> .....	South Carthage .....	
ANTHOMIID FLY .....	<i>Pegomia vicina</i> .....	Union .....	Mining beet leaves.
THE CURRANT FRUIT-FLY .....	<i>Epochra canadensis</i> .....	Augusta .....	Infesting the fruit of currants.
CARPET BEETLE .....	<i>Anthrenus scrophularie</i> .....	All parts of the State.	Attacking carpets.
THE STRIPED SAP-BEETLE .....	<i>Ips fasciatus</i> .....	Ellen .....	On forest trees sucking sap which ex-
			uded from wounds made by borers.
MAY BEETLE .....	<i>Lachnosterna fusca</i> .....	{ Cherryfield .....	In pastures.
THE CHERRY LEAF BEETLE .....	<i>Adimonia caricollis</i> .....	{ Walpole .....	Working on foliage of cherries.
BEAN WEEVIL .....	<i>Bruchus obtectus</i> .....	{ Lewiston .....	Working in dried beans.
PIGEON TREMEX. PIGEON HOBTAIL .....	<i>Tremex columba</i> .....	{ York Corner .....	Working on elm and other trees.
PELECINUS .....	<i>Pelecenus polygator</i> .....	{ East Lebanon .....	A black tenebrion with a long slender
		{ Subattus .....	pointed abdomen which is usually
		{ Winterport .....	curved.
LARRID BEE .....	<i>Larva</i> .....	{ Harrington .....	Burrowing in the ground.
		{ West Harrington .....	

The caterpillars are quite gregarious up to the later stages of their growth, when they disperse to some extent; but when they occur only in moderate numbers, they retain their gregarious habits to a greater degree than when they are very abundant, since in this case the supply of food is soon exhausted and they are forced to migrate. When these caterpillars molt they gather in masses on the branches and cover themselves with a scanty mass of silk. When preparing to change to the pupal stage several of the caterpillars spin up in a common cocoon within the leaves at the tip of the branches. When numerous, they frequently pupate in masses under fences and clapboards, or on the trunks and larger branches of the trees.

The webs of the brown tail moth should not be confounded with those of the tent caterpillar or the fall web worm. They may be distinguished from those of the tent caterpillar by being placed at the tips of the branches, while the tent caterpillar constructs its tent in a fork of the limbs. This latter insect rarely, if ever, attacks the pear which is a favorite food plant of the brown tail moth. The fall web worm, while often found on pear trees, spins a large open web at the ends of the branches and feeds within this web. This insect does not appear until after the brown tail moth has ceased to do damage.

*Precautions.* This pest does a great amount of damage in Europe where laws are enacted to hold it in check. The Commonwealth of Massachusetts has enacted a law looking to its suppression in that state and made an appropriation and put the matter into the hands of the Gypsy Moth Commission. Now that it is probably locally established in Maine immediate action should be taken to prevent its spreading. A careful inspection should be made of the localities where it has been found.

## NOTES ON PLANTS OF 1899.

F. L. HARVEY.

The past season was dry and the conditions unfavorable for the growth and spread of fungi and only a few were reported. The apple scab and potato blight were not as bad as usual. This was due in part to the dry season and probably in part to the greater amount of spraying done. There was not the usual number of weeds sent for determination and no new weeds are known to have been introduced the past season. Specimens of the following plants, mostly sent for identification, were received in 1899.

BLADDER CHAMPION. (*Silene vulgaris*). This plant seems to be increasing as a weed in cultivated fields.

SILVERY CINQUEFOIL. (*Potentilla argentea*). This is a common plant on rocky ledges in Maine and is spreading along roadsides in many places. It attracts attention on account of the silvery pubescence on the under side of the leaves.

BIENNIAL EVENING PRIMROSE. (*Oenothera biennis*). This tall weed, with bright yellow four-petaled flowers, is one of the most common in the State. It seeds heavily and growing in waste places is able to maintain itself. Its tall woody stems covered with four-celled pods are a common sight in winter.

GOLDEN ALEXANDERS. (*Thaspium trifoliatum aureum*). This is a native plant and not reported before as a weed in fields. It is a perennial plant, usually growing in the woods and probably will be easily subdued by cultivation.

HOBBLE-BUSH. (*Viburnum lantanoides*). This is a native shrub, with beautiful foliage and attractive flowers. It is worthy of cultivation.

CULTIVATED DAISY. (*Bellis perennis*). Like many other cultivated plants this species escapes from cultivation and appears in fields. It has not proved a persistent or bad weed.

ORANGE HAWKWEED. (*Hieracium aurantiacum*). This weed has been almost entirely destroyed on the college grounds by turning the grass land where the weed was thick and harrowing frequently through the season. Scattering plants in the fields were pulled and burned and the ground where they grew salted.

CANADIAN HAWKWEED. (*Hieracium canadense*). This is a coarse, leafy-stemmed weed, growing fully four or five feet high on good soil and bearing at the top a corymb of yellow beads. It is native and though sometimes found in fields, it has not shown a tendency to spread like its relatives, the orange hawkweed and king-devil weed.

RAGGED KNAPWEED. (*Centaurea Jacea*). This fugitive from Europe is common in some pastures of Maine, in fields and waste places. The large heads and the fimbriated outer bracts make it a conspicuous plant, sure to attract attention.

THE SAND BUR, BEAKED NIGHT SHADE. (*Solanum rostratum*). The sand bur is reported as occurring in fields. This objectionable weed has been found several times in Maine, usually about where cars of western grain were unloaded. It is more of a roadside weed in the West. It will probably not maintain itself in cultivated fields in Maine.

THE RATTLE-GRASS. (*Rhinanthus Crista-Galli*). This is a bad weed in sandy lands along the coast. There is probably no way to get rid of it, but by careful culture. It seeds profusely.

REED GRASS. (*Phragmites Phragmites*). This grass was received from Kenduskeag. It is rare in Maine, growing in wet places, and so we record the locality. It is sure to attract attention on account of its high and beautiful plumes. It grows from five feet to fifteen feet high and bears a silvery plume from six inches to a foot in length.

## THE MAINE EXPERIMENT STATION.

CHAS. D. WOODS.

The Legislature of 1885 enacted the law establishing the Maine Fertilizer Control and Agricultural Experiment Station. The purpose of the Station was defined in Section 1 of the Act (Chapter 294 Public Laws of 1885) as follows: "That for the purpose of protection from frauds in commercial fertilizers, and from adulterations in foods, feeds and seeds, and for the purpose of promoting agriculture by scientific investigation and experiment, the Maine Fertilizer Control and Agricultural Experiment Station is hereby established in connection with the State College of Agriculture and Mechanic Arts."

This act was approved by the Governor March 3, 1885, and early in April the Station was organized with a Board of Managers consisting of:

Prof. Walter Balentine, Professor of Agriculture in the Maine State College; Hon. Z. A. Gilbert, North Greene, Secretary of Maine Board of Agriculture; Benj. F. Pease, Cornish; Hon. S. L. Boardman, Augusta; and William Downs, Sebec. The officers of the Station consisted of Whitman H. Jordan, Director and Chemist; Jas. M. Bartlett, Assistant Chemist; Gilbert M. Gowell, Superintendent of field and feeding experiments.

The Station was dependent for its quarters upon the hospitality of the Maine State College. A chemical laboratory was partitioned off from the main college laboratory and supplied with apparatus. Part of the dairy room of the college was fitted up with apparatus for use in experiments involving the handling of milk. A part of the new barn just erected by the college was turned over to the Experiment Station for feeding experiments and was fitted up with stalls, scales, etc. Field experiments were started by laying off about three acres of land into plots, and box experiments for growing plants were also begun.

While the principal object of the establishment of this station was the maintenance of a fertilizer control, in the first months of its existence lines of investigation were entered upon which have been followed by the Station from that time.

Dr. Jordan was Director of the Station from 1885 to June 30, 1896, when he resigned to take the directorship of the New York Experiment Station. Mr. James M. Bartlett was appointed assistant chemist at the establishment of the Station and a year later Mr. Lucius H. Merrill was also appointed as assistant chemist. Both of these gentlemen have been associated with the Station continuously since their first appointment. Mr. Gilbert M. Gowell was appointed superintendent of field and feeding experiments and he still continues with the Station in the department of stock breeding and poultry.

#### THE REORGANIZATION OF THE STATION.

The Maine Fertilizer Control and Agricultural Experiment Station existed about two and a half years and issued twenty bulletins and three reports, the former being published only in the leading papers of the State and the later as a part of the report of the Maine Board of Agriculture. Upon the passage by Congress of what is known as the Hatch Act, establishing agricultural experiment stations in every state, the Legislature of 1887 repealed the law of March 3, 1885, by an act which took effect October 1, 1887. It was expected at the time this act was passed, that by October first a station would be in operation under the provisions of the national law. This did not prove to be the case, owing to the failure of Congress to appropriate money, and had not the College assumed the risk of advancing the funds to pay the expenses of the Station, work would have ceased on the date in which the old station law stood repealed. As it was, work was continued until January, 1888, when the station force disbanded to await the action of Congress. It was not until after the passage of the deficiency bill early in February, 1888, that funds became available for the payment of the expenses of the year 1887-1888. Prior to this, the Maine Legislature of 1887 had accepted the provisions of the Hatch Act on the part of the State, and at the meeting of the College Trustees in June.

1887, the present Station was organized as a department of the College by the election of a director and two other members of the staff of officers.

At a meeting of the trustees, held February 16, 1888, a general plan for carrying out the provisions of the Hatch Act, involving the expenditure of \$15,000 per annum, was presented to the Board of Trustees and was accepted by them, and the development and management of the Station under this plan was placed in the charge of a Station Council, made up of the President of the College, the Director of the Station, the heads of the various departments of the Station, three members of the Trustees and a representative from the State Board of Agriculture, the State Pomological Society and the State Grange.

The Station Council meets once a year and out of town members have their travelling expenses paid. At this meeting, the Director and other members of the station staff outline the work which has been undertaken in the past year and make recommendations for the following year. Such of these as commend themselves to the Station Council as well as suggestions from that body are approved and the Director is instructed to carry them out in detail. The appointment of members of the staff is made by the Trustees, and the recommendations of the Council are subject to their approval.

The Director is the executive officer of the Station and passes upon all matters of business. The members of the staff have charge of the lines of work which naturally come under their departments.

#### RELATION OF THE STATION TO THE UNIVERSITY.

When the legislature accepted the Hatch grant, it made the Experiment Station a part of the University. As the University is a state institution, it (including the Experiment Station) is under the same inspection as other departments of the State. The agriculture of the University is organized as the College of Agriculture, and includes both the instruction in agriculture and the work of investigation. The Professor in charge of the College of Agriculture is also the Station Director. Formerly the Experiment Station had a farm of about thirty acres and the remainder of the land was under the management of the Uni-

versity. In 1897, the whole farm was placed under the management of the Station. Its accounts are kept entirely distinct from the University and from the Hatch fund accounts. Both the University and the Hatch fund make appropriations, one for the privileges of instruction, the other for maintaining the experimental work. By this consolidation there was made a marked reduction of the expenses of the farm. After the College of Agriculture has used what facilities it may need for the purpose of instruction and the Experiment Station has used the land and animals needed for investigations and experiments, the remainder of the farm and livestock are handled for profit.

#### EQUIPMENT OF THE STATION.

The equipment of the Station consists of an office and laboratory building 60x25 feet and a wing 20x22 feet, constructed of brick with granite trimmings. The basement and first floor of this building are devoted to chemical laboratory purposes and the upper floor contains the laboratory of the veterinarian and the station offices.

In this building there are thoroughly equipped analytical laboratories for investigations of foods and feeding stuffs, fertilizers, soils, etc.

The Horticultural Building consists of a head-house, three green houses and a potting house. The plant covers over 6,000 square feet of surface and is used for the purpose of investigation and that of instruction. The head house contains the offices of the professor of horticulture and his assistant, work room, store room, and photographic rooms, as well as rooms for the station janitor.

The Dairy Building is a wooden building 50x42 feet, containing on the first floor a butter room, a cold storage room, a cheese room, a milk room and a boiler room. On the second floor is a lecture room, offices, and a cheese curing room. The apparatus includes hand and power separators of several different forms, creamers, hand and power churns and butter workers, cream and cheese tempering vats, weighing tanks, hand and power Babcock milk and cream testers of different makes, Russell pasteurizing apparatus, milk aerator, and the other appliances necessary. Power is furnished by a 6-horse power engine

and by a baby tread horse power. This building is used by the Station and the College of Agriculture.

The upper barn is 40x100 feet. It has a solid stone foundation, resting directly upon the underlying ledge. The tie-up is on the south side of the main floor, and contains seventeen stalls, solidly constructed of birch. The barn contains scales for weighing experimental cattle, bins for the rations of experimental animals, rooms for grain, for storage and for digestion experiments, and a silo. The walls and partitions are of spruce sheathing.

The lower barn is 50x100 feet and has a storage capacity of 150 tons of hay. It contains a tie-up recently rebuilt, consisting of twenty-six stalls of a new and improved pattern, two grain rooms, two bull rooms, nursery, calf room, and silo. The silo is thirty-six feet deep and will contain 100 tons of cut corn. The basements of the barns contain manure cellars, store rooms and pens for swine.

The other buildings consist of a hospital barn, 25x40 feet; a two-story tool house, 25x60 feet; a horse barn 30x40 feet; sheep barn 20x120 feet; poultry breeding house, 16x150 feet; twelve poultry brooder houses, 8x10 feet. The farm contains eighty acres under cultivation and about forty acres in pastures and paddocks, varying amounts of which are used for experimental purposes. The livestock consists (April, 1900) of 5 horses; 32 cows; 20 calves and yearlings; 2 bulls; 48 swine and pigs; 67 sheep and lambs; 500 hens. Part of all the above are under experiment.

The Station has quite an extensive collection illustrating the economic botany and entomology of the State. The Station library consists of 1,200 volumes. In addition to its own books, the Station has access to the scientific library of the University and also to the State library at Augusta.

The Station is well equipped in apparatus, particularly that which has to do with chemical, botanical, entomological and horticultural investigations. The farm department is unusually well supplied with modern farm machinery.

## INCOME OF THE STATION.

The revenue of the Station prior to 1888 was \$5,000 per annum from the State, and fertilizer fees, the total income being something over \$6,000 a year.

At present, the annual income of the Station is about \$22,000, \$15,000 of which comes from the Hatch fund, something over \$5,000 from the fertilizer and feeding stuffs control, and the remainder from miscellaneous business and sales of produce. The State makes no appropriation for the Station. Its funds come entirely from the National Government and from fees and sales of produce.

## THE OBJECT OF THE STATION.

The purpose of the experiment stations is defined in the act of Congress establishing them as follows:

"It shall be the object and duty of said experiment stations to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural and artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective states or territories."

## INSPECTIONS.

In accepting the provisions of the act of Congress, the Maine Legislature withdrew the state appropriation for the maintenance of the Station, and thereby did away with the original

purpose of the Station so far as it related to the "protection from frauds in commercial fertilizers, and from adulterations in foods, feeds and seeds." In place of this, special laws regulating the sale of commercial fertilizers, concentrated commercial feeding stuffs and agricultural seeds, and the inspection of chemical glass-ware used by creameries, have been enacted. The Director of the Station is the executive officer of these laws; the Secretary of Agriculture is the prosecuting officer. The cost of the fertilizer inspection is borne by a brand tax, that of the feeding stuff inspection by a tonnage tax and that of chemical glass-ware by a charge for calibration.

#### DISSEMINATION OF INFORMATION.

The annual report and bulletins of the Station cover its operations and give a full account of all its work. Up to April, 1900, the Station has published 90 bulletins and 15 annual reports, making a total of nearly 3,500 pages of printed matter. These publications are regularly sent to about 8,000 persons resident in the State, and 1,500 outside of the State. The special calls for the bulletins require an edition of about 10,500 copies. The Station has 2,000 copies of its annual report and 10,000 copies are distributed by the Board of Agriculture bound with its report.

Each month the Station issues a special newspaper bulletin giving the meteorological report for the month, and from time to time it issues newspaper bulletins on special topics which are very generally printed by the press of the State. In a few instances the Station has sent posters on important matters, to railway stations, post offices, granges, etc., which have been very generally displayed.

The Station has a large correspondence chiefly with practical farmers in the State. Careful attention is given to all inquiries and it is believed that in this way the Station is increasingly helpful to the farmer. The Director and three members of the Station staff do more or less work in farmers' institutes and other lectures. While it is believed that this work is helpful, no more of it is done than seems to be necessary, as it encroaches upon the work of investigation.

## THE WORK OF THE STATION.

While the Station carries on co-operative work, such as orcharding, blueberry culture, and field experiments with farmers in different parts of the State, most of its work of investigation is from necessity, carried on in its own laboratories, greenhouses, barns and fields. Its special investigations have been along the lines of the nutrition of plants, the nutrition of animals (including man), and injurious insects and fungi.

## SOME OF THE MORE IMPORTANT INVESTIGATIONS AND THEIR RESULTS.

Detailed accounts of the work of the Station have been given in its publications; nevertheless it seems appropriate to briefly summarize some of the leading experiments and the results obtained. In thus doing no reference is made to the report or bulletin in which they were described. The report of 1896 contains a general index to all the publications prior to January, 1897, and the three later reports are each indexed. If any one cares to look up the original papers, they can in this way be readily found.

## FERTILIZATION OF FLOWERS, WITH REFERENCE TO THE SECONDARY EFFECTS OF POLLINATION.

The subjects receiving particular attention thus far are (1) the immediate influence of pollen on the mother plant; (2) stimulating action of pollen and the effects of varying amounts; (3) agamic development of fruit.

*Results:* (1) Within certain restricted limits there is an immediate influence of pollen on the mother plant. The most important plants showing this influence are the pea, the kidney bean, and Indian corn. Sweet corn shows the immediate influence of foreign pollen more frequently than do the other races of corn. Cucurbitaceous and solanaceous plants have never been found to exhibit such influence. There appears to be no relation between the amount of pollen produced by a plant and the amount required for fecundation. In some species, notably the egg-plant, the bean, and the cucumber, the ovary developed in the entire absence of pollen; but in no case where pollen was

withheld were perfect seeds formed. (2) The amount of pollen supplied was found to have an important bearing on the form and size as well as the quantity of fruit produced. The form and size of tomato fruits was found to be directly dependent upon the amount of pollen furnished—a small amount invariably resulting in small and deformed fruit. (3) Indications point to the possibility of distinct effects from two male parents when pollen is applied to the same stigma at different times.

#### EXPERIMENTS WITH THE TOMATO.

With the tomato the following questions were considered: Effect of early setting in the field; effect of trimming the vines; effect of bagging the fruit to induce early ripening; the effect of crossing; the cumulative effect of culture under glass. *Results:* It was found that a chill to tomato plants after setting is not necessarily fatal to success, and that, other things being equal, the earliness and productiveness of tomatoes are in direct ratio with the earliness of setting in the field. Trimming the plants, after a part of the fruit had set, increased the yield by more than one-third. The results from bagging the fruit were in general of a negative character. Crossing between small fruited plants of prolific habit and the ordinary large fruited type was found to be a promising method of securing a valuable type for localities where the season is short. The increase in yield of the Lorillard-peach cross over that of the pure Lorillard was nearly 50 per cent. A derivative hybrid between Lorillard and currant produced a type of special excellence for forcing. In some instances seed from plants grown under glass gave better results in house culture than did seed of the same variety grown in the field. Results were not uniform, however, and there appeared to be distinct varietal differences.

#### STUDIES WITH THE CABBAGE.

Cabbage studies included investigations as to the importance of deep setting of the plants; the effect of frequent handling; the effect of trimming at the time of setting. *Results:* Contrary to the general notion concerning the treatment of "leggy" plants, it was found that depth of setting had very little influence upon

the size of the head. Plants handled three or more times invariably gave better results than those handled once or twice before the transfer to the field. Frequent transplanting increased the average size of the heads. Handling the plants in pots before setting in the field increased the percentage of marketable heads; but trimming the plants at time of setting appeared to be of no special importance.

#### EGG PLANT.

Egg plant studies included methods of culture; varieties; crossings. *Results:* It was demonstrated that with careful treatment the egg plant may be successfully grown in Central Maine,—the most important requisites being: early sowing; vigorous plants; late removal to the field; warm, rich soil. Most of the well-known varieties are too late for this climate, but early dwarf purple, early long purple and long white were satisfactory. Several crosses were made between white fruited and black fruited types. After four years of breeding it was found that no type sufficiently constant in color to be of commercial value was produced. There was, however, a marked increase in vigor and productiveness as a result of crossing. In the first generation the purple fruited types seem stronger in their power to transmit color to the offspring than do the white fruited types; and this law appears to hold whether the purple type is used as the male or female parent. In later generations the inherent strength of the white fruited types appears more strongly than in the first. In all cases the white fruited types appear stronger in the power to transmit form and productiveness.

#### CAULIFLOWER.

Work with the cauliflower included studies of the relative influence of pot and box culture of young plants; the effect of trimming at time of setting in the field; the effect of mulch as compared with frequent cultivation; a comparison of varieties. *Results:* Plants handled in pots were kept at a more nearly uniform rate of growth and produced a higher percentage of marketable heads,—this difference in some cases amounting to 20 per cent. As a result of trimming it was found that there was practically no difference in earliness nor in the size of head,

while as a rule the per cent of heads formed was greater from plants not trimmed. In no case were as satisfactory results obtained from mulching as from frequent cultivation. Nearly all of the leading varieties have been grown, and it is evident that the cauliflower may be successfully cultivated in this region. The most valuable sorts are of the Dwarf Erfurt and Snowball type with Algers for late in the season.

#### RADISH.

With the radish, the principal questions considered have been the relative value of large and small seed; the effect of sub-watering in the greenhouse; the influence of different temperatures on period of maturity. *Results:* Large seed were found to produce from 30 to 50 per cent more first-class roots than did small seed from the same lot. The sub-watered section of the bench produced 12 to 16 per cent more first-class radishes than did the surface watered section. There was a much greater loss from damping off on the surface watered section. The crop matured earlier and was of better quality when grown in the tomato house, with a night temperature of 80 degrees, than when grown at a lower temperature.

#### THE PRODUCTION OF FOOD MATERIAL BY VARIOUS FODDER AND ROOT CROPS.

Several varieties of fodder corn and roots were grown to determine the relative amounts of digestible dry material produced. *Results:* The large variety of fodder corn greatly excelled the other crops in the production of total and digestible dry matter. The crops which rank next in the production of digestible dry matter are Hungarian grass and rutabaga turnips.

#### THE INFLUENCE OF MATURITY UPON THE COMPOSITION OF THE CORN PLANT.

Field corn was harvested at five different periods of growth, and the products analyzed. *Results:* During the thirty days before the mature crop was harvested there was a continuous and large increase in the percentage of dry matter. This was

due to an actual growth of dry matter, rather than to a drying out of the water with a diminished weight of crop. The increase was largely from the growth of starch, sugar and allied bodies.

#### SPRAYING.

Spraying with fungicides and insecticides has received considerable attention. Among the questions studied are the following: The effectiveness of the treatment in producing perfect fruit; the relative number of windfalls on sprayed and unsprayed trees; the preparation of spraying mixtures; the best time for spraying. *Results:* All trees sprayed with arsenical poisons had a smaller percentage of wormy fruit than did the unsprayed. Paris green was found less injurious to the foliage than was London purple or white arsenic. A mixture of 1 pound Paris green in 250 gallons of water was effective in reducing the amount of wormy fruit, but a stronger mixture (1 pound to 100 gallons) was required to kill the tent caterpillar. The number of windfalls was greatly lessened by spraying with Paris green and the proportion of wormy fruit among the windfalls was also smaller from the sprayed trees.

It was observed that most often wormy fruits from sprayed trees are entered from the side or base, while in fruits from unsprayed trees the entrance at the calyx were largely in excess. Spraying trees three times with an ammoniacal solution of copper carbonate destroyed the apple scab fungus and resulted in saving 52 per cent of the crop. The most effective fungicide used was Bordeaux mixture and this is now generally used throughout the State.

#### INJURIOUS INSECTS.

The department of entomology and botany was established in the Station in 1898. The work of investigation has consisted of studies in the field and laboratory of the life histories of insects and plants of economic importance. This has resulted in an increased knowledge of old enemies and means of combating them and in the working out of the complete life history of *Trypeta pomonella* (apple maggot) and *Epochra canadensis* (currant fly), and the discovery of numerous facts regarding the habits of many other insects of economic or entomological

importance. Work of this character cannot well be summarized in definite statements. The results are published in the annual reports beginning with 1888.

#### ACQUISITION OF ATMOSPHERIC NITROGEN—NITRAGIN.

The acquisition of atmospheric nitrogen by plants has received attention. A bibliography of the subject has been compiled and the special features of soil inoculation has been studied. In carefully sterilized soil several of the "nitragin" cultures were compared with each other and with tubercles from various leguminous plants. The plants used in the work included red clover, pea, bean, vetch and soja bean. *Results:* The experiments thus far carried on do not warrant the recommendation of germ cultures for leguminous crops. In very few cases did the culture of the specific germ of any given species give better results than did a culture of a nearly related type.

#### BOX EXPERIMENTS WITH FELDSPAR AS A SOURCE OF POTASH.

*Results:* Oats were able to draw from the feldspar enough potash for a large crop of grain.

#### BOX EXPERIMENTS WITH PHOSPHORIC ACID FROM DIFFERENT SOURCES.

Phosphoric acid was supplied to 18 different kinds of plants in three forms, viz., (1) acid phosphatic rock; (2) finely ground Florida rock; (3) roasted redonda (a native phosphate of iron and aluminum). *Results:* Plants differ in their ability to feed upon crude phosphates. In nearly every case the availability proved to be in the order above given. The use of the acid rock hastens the maturity of the crop. The solubility of a phosphate in ammonium citrate is not always a correct measure of its actual value to the plant.

#### EFFECTS OF DIFFERENT FORMS OF PHOSPHORIC ACID IN CROP PRODUCTION.

*Results:* For the first year the largest increase of crop was produced by soluble phosphoric acid. For the second and third years without farther addition of fertilizers, better results were

obtained from the plots where stable manure and insoluble phosphates had been used.

#### THE RELATIVE UTILITY OF DIFFERENT FORMS OF PHOSPHORIC ACID IN FIELD EXPERIMENTS.

*Results:* The phosphoric acid of bone and South Carolina rock was quite freely appropriated by oats, peas and corn.

#### EXPERIMENTS IN FEEDING LAMBS.

The effects of liberal feeding versus moderate feeding for growing early lambs was studied. The results were very much in favor of liberal feeding. The sheep and lambs payed at the rate of \$71.60 per ton for the extra grain used.

#### EXPERIMENTS IN FEEDING COLTS.

Oats were compared with other mixed grain foods for producing growth with the result that a greater growth was produced by the mixed grains and hay than with oats and hay.

#### EXPERIMENTS IN FEEDING SWINE.

Many feed experiments have been made with swine. The more important questions studied were:

- (1) The value of corn meal compared with whole corn for growth.
- (2) Raw versus boiled potatoes for growth.
- (3) The most efficient ratio of nutrients in a ration.
- (4) The relation between the nutritive ratio and character of the growth.
- (5) The relative value of animal and vegetable protein.
- (6) The effect of much water in food upon assimilation.
- (7) Experiment in feeding different breeds. Two each of Berkshires, Cheshires, Poland China, Chester white, and Yorkshires were used. The rations consisted of wheat middlings and skimmed milk, liberally fed according to age of animal. Daily growth, Cheshires, 1.23; Yorkshires, 1.14; Chester white, 1.08 pounds; Poland China, 1.01; Berkshire, 1 pound.

*Results:* (1) The same weight of whole corn produced almost the same growth as when the corn meal was fed.

(2) The apparent value of potatoes is not materially increased by boiling.

(3) In six feeding periods comparing wide and narrow rations, (one having a nutritive ratio of 1:9.2 and the other a ratio of 1:5.5) it took nearly one-half more food to produce a pound of growth with the wide ration than with the narrow. Rations with nutritive ratio of 1:6, 1:5.6, and 1:3.6, 1:4.4 were compared. The two latter rations produced no better growth than the two former, showing that the added protein of the very narrow rations was not advantageous.

(4) The nitrogenous rations proved to be best not only for growth but for the fattening period. A mixture of pea meal or gluten meal and corn meal was much more efficient than corn meal alone for fattening.

(5) In the case of young pigs the animal food (skimmed milk) was superior to the grains, but with the older animals the amount of digestible nutrients seemed to be the measure of value.

(6) The amount of water taken with the food appeared to have no particular effect on the growth.

(7) The digestible food consumed for a pound of growth was as follows: Cheshires, 2.88 lbs; Poland China, 2.73 lbs; Yorkshire, 2.55 lbs; Chester white, 2.5 lbs; Berkshires, 2.45.

In the early stages of the experiment much less food was required for a pound of growth than in the later. Berkshire and Chester whites made a larger part of their growth during the first three months.

#### DIGESTION EXPERIMENTS WITH SHEEP.

Since the organization of the Station, digestion experiments with sheep have formed a prominent feature of its work. The experiments have been largely with the forage crops, grown in this State, although several mill products have been tested with other work. Seventy-one different digestion experiments with native or cultivated hays or grasses; 24 experiments with dry corn fodder; 20 experiments with silage corn; 10 experiments with roots and 20 with mill products have been made. The summary of the results of the digestion experiments then completed is given in the annual report of this Station for 1897.

In addition to determining digestion coefficients, in many cases other problems have been studied such as the relative digestibility of early and late cut hay, of green and dried grasses; of mature and immature corn fodder and silage; of fodder and silage from different varieties of corn and of the oat plant in different stages of maturity.

#### THE VALUE OF MANURE RESIDUE FROM CORN MEAL AND COTTONSEED MEAL WHEN FED TO SHEEP.

*Results:* The amounts of nitrogen, phosphoric acid, and potash in the manure residue stand in direct relation to the amounts of the same ingredients in the food. The urine contained nearly one-half the potash of the total excrement, one-half to three-fourths the nitrogen, but no phosphoric acid.

#### EXPERIMENTS IN FEEDING STEERS FOR GROWTH.

(1.) A comparison of the economy of feeding a ration of hay and corn meal with a ration of oat straw, corn meal and cottonseed meal. *Results:* The steers fed the oat straw and mixed grain ration made the cheaper growth. The two rations contained about the same digestible nutrients and produced about the same amount of growth, the difference being in the cost of the rations.

(2.) Economy in quantity and composition of the foods used. Ten steers about eighteen months old of uniform size were divided into five pairs and fed five different rations: A, a maintenance ration; B, a moderate but wide grain ration; C, a moderate well balanced ration; D, a liberal well balanced ration; E, oat straw substituted for hay with moderate, well balanced grain ration. *Results:* It required nineteen pounds hay to 1,000 pounds live weight to maintain an animal without loss. The cost of producing a pound of growth was least when a liberal well balanced ration was fed. The substitution of nitrogenous foods in the rations greatly diminished the cost of production.

(3.) A comparison of the feeding value of corn silage with hay. Six steers were used in the experiments. Moderate grain rations were fed. *Results:* A pound of digestible matter from

the corn silage produced somewhat more growth than a pound of digestible matter from the hay, but the difference was slight. The digestible matter appeared to be the measure of value of the foods.

THE RELATION OF FOOD TO THE GROWTH AND COMPOSITION  
OF THE BODIES OF STEERS.

The experiment had for its object a study of the effect of widely different rations upon the rate of growth and composition of the bodies of steers. Beginning at the age of four to six months, two pairs of steers were fed from seventeen to twenty-seven months on rations differing widely in their nutritive ratio, one ration having a ratio of 1 : 5.2 and the other 1 : 9.7. One pair ate 1884 pounds of digestible protein in the same time the other pair ate 1,070 pounds.

One steer of each pair was slaughtered and analyzed at the end of seventeen months feeding, the remaining steers being fed for ten months longer, when they were killed and analyzed. The chemical analysis included the entire bodies, excepting the skin and the contents of the stomach and intestines.

*Results:* At the end of fifteen months feeding, the pair of steers fed on the ration richer in protein had gained 221 pounds of live weight more than the pair fed the ration less rich in protein. The later growth with two steers showed a difference in favor of the ration less rich in protein.

The relative weights of organs and parts of the body was practically the same with the steers of the same age, independently of the ration.

The kind of growth caused by the two rations, viz., the proportions of water, protein, fat and ash, was not materially different with the steers of the same size. This is true whether we consider the entire bodies, the dressed carcasses or the edible portions of the carcasses. With steers fed for the same time, the composition of the entire bodies, the proportion and composition of the carcasses, and the proportions and compositions of the edible parts were practically alike.

The older pair of steers, viz: those fed for ten months longer time, contained a smaller proportion of water and a larger proportion of fat than the younger animals.

The older animals furnished five pounds per hundred more of water-free edible material than the younger animals. This is equivalent to a difference of twelve pounds of fresh, edible meat.

#### EXPERIMENTS WITH COWS.

An experiment in feeding wide and narrow rations to cows for milk production. Equal amounts of digestible matter were fed in each ration. The nutritive ratio of one ration was 1 : 12.3, the other 1 : 6.7. *Results:* The general appearance of the cows was best when fed the nitrogenous ration and the yield of milk was 1-5 to 1-2 larger. The milk was some richer and the daily yield of milk solids was thirty to forty per cent larger on the nitrogenous rations than the milk ration.

Average daily yield milk solids on nitrogenous ration. 3.07 lbs.

Average daily yield milk solids on wide ration. . . . . 2.28 lbs.

	Solids—%	Fat—%
Average composition of milk on nitrogenous ration . . . . .	14.11	4.83
Average composition of milk on wide ration. . . . .	13.54	4.34

#### AN EXPERIMENT TO TEST BREEDS OF DAIRY COWS.

The breeds tested were Holsteins, Ayrshires and Jerseys. The experiment continued two years. The following points were studied: (1.) Amount of food and nutrients. (2.) Yield of milk, solids, fat, cream and butter, and relations in quantity which these sustain; and (3.) The food cost of milk, milk solids, fat, cream and butter and incidentally the composition of the whole milk, skimmed milk, and butter milk from the different animals.

*Results:* (1.) The average amount of water-free food consumed daily for each animal was: Holstein, 27.4 pounds; Ayrshire, 24.7 pounds; Jersey, 28.3 pounds.

(2.) The annual yield of milk solids was: Holsteins, 1,014 pounds; Ayrshire, 848 pounds; Jersey, 827 pounds; and of butter fat, Holstein, 285 pounds; Ayrshire, 233 pounds, and Jersey, 297 pounds. Milk required for a pound of milk solids, Holstein, 8.3 pounds; Ayrshire, 7.8 pounds; Jersey, 6.6 pounds; for a pound of butter fat, Holstein, 29.4; Ayrshire, 28.3; Jersey, 18.2.

(3.) The cost of a quart of milk, reckoning the cattle foods at market prices was: Holstein, 1.83 cents; Ayrshire, 2.03 cents; Jersey, 2.42 cents. The food cost of a pound of milk solids was for Holstein, 7.09 cents; Ayrshire, 7.45 cents; Jersey, 7.44 cents; of a pound of butter fat, Holstein, 25.22 cents; Ayrshire, 26.62 cents; Jersey, 20.43 cents.

The average composition of the milk for the two years was:

	Solids—%	Fat—%
Holstein .....	12.22	3.47
Ayrshire .....	12.98	3.67
Jersey .....	15.24	5.50

The loss of fat in the skimmed milk was least for the Jerseys. Solids of skimmed milk were: Holstein, 9.50%; Ayrshire, 10.40%; Jersey, 10.50%.

#### AN EXPERIMENT TO COMPARE MAINE FIELD CORN SILAGE WITH SOUTHERN CORN SILAGE.

*Results:* The Maine field corn silage was found to have nearly  $\frac{1}{3}$  more digestible matter than the silage from the immature southern corn.

In the feeding trial, thirty pounds of the Maine field corn silage produced more flesh and milk than forty pounds of the southern corn silage.

#### AN EXPERIMENT TO COMPARE A LARGE RATION OF HAY WITH A MEDIUM RATION.

The rations consisted of (1) 13 pounds hay, 25 pounds silage, 7 pounds grain, (2) 8 pounds hay, 25 pounds silage, 7 pounds grain.

*Results:* The ration with the larger amount of hay proved the more efficient.

#### AN EXPERIMENT TO COMPARE THE FEEDING VALUE OF WHEAT MEAL WITH CORN MEAL.

Ration 1 consisted of hay, 18 pounds; wheat meal, 5 pounds; cottonseed meal, 2 pounds; and ration 2 of hay, 18 pounds; corn meal, 5 pounds; cottonseed meal, 2 pounds.

*Result:* The wheat meal in the combination was somewhat more efficient than the corn meal, and at about the same price can be economically substituted for it. The cows gained in weight on the wheat meal ration and produced slightly more milk than on the corn meal ration.

AN EXPERIMENT TO COMPARE GLUTEN MEAL WITH COTTON-SEED MEAL FOR MILCH COWS.

*Results:* The two foods proved to have equal efficiency when fed in amounts to furnish equal quantities of digestible matter.

AN EXPERIMENT TO COMPARE GROUND OATS WITH WHEAT BRAN AS FOOD FOR MILCH COWS.

*Results:* The ground oat ration produced slightly more milk, solids and fat than the bran, and when they can be purchased at about the same price make an excellent substitute for it.

AN EXPERIMENT TO SUBSTITUTE SILAGE FOR A PART OF THE GRAIN RATION OF MILCH COWS.

The silage used was the so-called Robertson mixture, consisting of matured corn (ears glazed), sun flower heads and horse beans. Six cows were used. The rations fed were: (1) Hay, 15 pounds; silage 20 pounds; grain, 8 pounds. (2) Hay, 15 pounds; silage, 35 pounds; grain, 4 pounds.

*Results:* Ration 2 in which silage was substituted for a part of the grain ration was fully equal to ration 1, producing as much milk and a greater gain in weight of cows.

AN EXPERIMENT IN FEEDING NUTRIOTONE.

This is a patent food or medicine, claimed by manufacturers to stimulate growth and milk production.

Five cows were fed three periods of twenty-one days each liberal rations of hay and grain. The rations were weighed. In the second feeding period, two spoonfuls of nutritone (according to directions in the package) were added to the grain ration.

*Results:* The nutritone had no visible effect. The cows in twenty-one days without nutritone produced 2,281 pounds milk and 101 pounds fat. The cows in twenty-one days with nutritone produced 2,264 pounds milk and 101 pounds fat.

AN EXPERIMENT TO TEST THE EFFECT OF FOOD ON THE HARDNESS OF BUTTER AND COMPOSITION OF BUTTER FAT.

The primary object of the experiment was to study the effect of liberal rations of corn gluten meals containing large and

small amounts of fat on the hardness of butter, and butter fat. Eight different gluten meals were used, varying in fat content from one per cent to nineteen per cent, also in other feeding trials gluten feed, flax meal, and cottonseed meal. Eleven cows were employed and twelve tests made. The feeding periods were from two to four weeks each and extended over three years. *Results:* The gluten meals with high fat content produced soft butter with fat of low melting point and high iodine number.

Gluten meals containing very small amounts of fat or oil, made butters of about normal firmness. When tallow was added to the ration, the hardness of the butter was somewhat increased. Cottonseed meal produced a hard butter. The hardness of butter can be regulated to a large extent by the food of the cows.

#### THE MINERAL INGREDIENTS OF MILK.

Analyses were made of the ash of the milk, from six cows, representing three breeds. *Results:* The differences in composition were great, even with cows of the same breed. The potash and phosphoric acid were the most variable constituents.

#### THE FAT GLOBULES OF MILK.

The milk of five cows, representing three breeds, was examined and the relative size and number of the globules determined, in both the whole and skimmed milk. *Results:* The globules of the milk from the Jersey cows were much larger than in the milk from the cows of the other breeds. In every case the globules of the skimmed milk were less than one-half the size of those from the whole milk.

#### EFFECTS OF TUBERCULIN ON TUBERCULOUS COWS.

The tests were applied to a herd of fourteen cows and cover periods of from one to two years. *Results:* The tests together with the autopsies indicate that tuberculin is a very delicate agent for determining the presence of tuberculosis. It is very doubtful if cows ever react under a properly made tuberculin test unless they have tuberculosis. On the other hand, it is very evident that cows sometimes have tuberculosis, or, at least, tuberculosis growths in their bodies, and yet fail to react under the tuberculin test.

## A NEST BOX FOR KEEPING INDIVIDUAL EGG RECORDS.

An attempt is being made to establish families of hens that shall excel as egg producers. To do this it is necessary to make careful selections for which the individual records must serve as a basis. The nest box devised is believed to serve the purpose admirably.

THE NUMBER OF LAYING HENS THAT CAN BE PROFITABLY KEPT  
IN ONE PEN.

Varying numbers of hens were confined in pens having each 160 feet floor space. *Results:* The maximum production per hen was obtained when the least number of hens (15) was confined to one pen; but the pens containing twenty birds gave a greater total net profit than did those containing any greater or less number of birds.

EXPERIMENTS UPON THE DIGESTIBILITY OF BREAD WITH MEN  
WITH SPECIAL REFERENCE TO PROTEIN.

*Results:* Digestibility of protein of

White bread and milk.....	92.8%
Graham bread and milk.....	88.5%
Entire wheat bread and milk.....	91.9%

## THE DIGESTIBILITY OF BREAD ALONE.

A continuation of the work outlined above. The approximate availability of the nutrients of butter, milk and sugar being known, a correction of the first results obtained was made possible.

*Results:* Digestibility of protein of

White bread alone.....	88.3%
Graham bread alone.....	77.0%
Entire wheat bread alone.....	86.6%

## DIETARY STUDIES.

Investigations were carried on at the College Commons for a period of 209 days. *Results:* The cost of the animal foods was 69 per cent of the total food cost. The freer use of milk did not increase the gross weight of food eaten. The increased consumption of milk had the effect of materially narrowing the

nutritive ratio of the dietary, while at the same time the cost of the dietary was diminished. Milk should not be regarded as a luxury, but as an economical article of diet.

#### SKIMMED MILK OR WATER IN BREAD MAKING.

An experiment designed to show the increased value of bread in which skimmed milk has been substituted for water. *Results:* Skimmed milk bread contains more protein than water bread and is as completely digested.

#### PUBLICATIONS OF THE STATION.

The Station has purchased 15 annual reports and 88 bulletins. The first 26 bulletins were newspaper bulletins published prior to the reorganization of the Station in 1888. All matter of permanent importance was included in the reports. The first number of the present series of bulletins was published May 1, 1889.

The titles of the principal papers in the reports and of the bulletins follow. The mark \* preceding a report or bulletin denotes that the edition is nearly or quite exhausted. Copies of the publications not marked \* will be sent on application so long as the numbers on hand will allow. The reports of this Station are bound with those of the Secretary of Agriculture, so that anyone having the "Agriculture of Maine" has also the report of the Station for that year.

#### \*REPORT FOR 1885.

Inspection of fertilizers.

#### REPORT FOR 1886.

Inspection of fertilizers. Wood ashes. Harbor mud. Ashes vs. acid for treating ground bone. Purchase of fertilizing material. Manure residue of corn meal and cotton-seed meal. Composition of cattle foods and special foods. Digestion experiments with timothy hay and corn in various forms. Feeding cotton-seed meal for milk and butter production. Feeding steers for growth.

#### \*REPORT FOR 1887.

Inspection of fertilizers. Miscellaneous fertilizers. Experiments with fertilizers at the Station and among farmers. Analyses of feeding

stuffs. Digestion experiments. Feeding experiments for milk and butter and for growth. Inquiries concerning cattle foods. Tests and varieties, grain and potatoes. Experiments in raising cream. Adulteration of molasses. Insecticides. Analytical and experimental methods.

#### REPORT FOR 1888.

Inspection of fertilizers. Digestion experiments with sheep. The compounding of rations for farm animals. The composition and digestibility of American feeding stuffs. Tests of varieties of potatoes, oats, barley, and peas. Germination tests of seeds. Description of the following injurious insects: Round-headed apple-tree borer; Flat-headed apple-tree borer; Oyster-shell bark louse; Apple-tree tent-caterpillar; Forest tent-caterpillar; Fall canker-worm; Eye-spotted bud-moth; Apple-tree aphid; Codling moth; Apple maggot; Ash-gray pinion; Pear-tree slug; Indian cetonias; Plum curculio; Cherry-tree plant louse; Imported currant-worm; Ivy scale insect; Black swallow-tail butterfly; Eyed elater; Hawthorn tinging; Mourning cloak butterfly; Meal-worm beetle.

#### REPORT FOR 1889.

Inspection of fertilizers. Composition, digestibility and yield of corn-fodder and hay from various grasses. Composition and value of various commercial feeding stuffs. The comparative digestibility of wheat bran and wheat middlings. Composition and digestibility of pea meal. The value of the digestible matter of good hay as compared with the digestible matter of corn ensilage, for milk production. The value of the digestible matter of ensilage as compared with the digestible matter of hay, for growth. Feeding experiments with swine. Tests of several breeds of dairy cows. Field and pot experiments with fertilizers. Field tests with varieties of barley, oats and peas. Seed germination experiments. Experiments with forage plants. The potato rot. Apple scab. The apple maggot. Insecticides. Hog cholera. Parturient apoplexy, (milk fever). The coefficients of digestibility for protein. Loss of food and manurial value in selling sweet corn.

#### REPORT FOR 1890.

Inspection of fertilizers. Tests of dairy cows. Mechanical loss of butter fat. Effect of delay in setting milk. The mineral ingredients of milk. The fat globules of milk. Tuberculosis in the college herd. Feeding experiments with colts, steers, and swine. Field experiments with fertilizers. Germination tests of seeds. Spraying experiments. Injurious insects. Meteorological observations.

#### \*REPORT FOR 1891.

Inspection of fertilizers. Station equipment. Digestion experiments. Production of food material by various fodder and root crops. Turnips for sheep. Producing growth in lambs. Feeding experiment with colts.

Influence of food on butter. Babcock milk test for cream. Equipment of horticultural department. Notes on cabbage, tomatoes and egg plants. Spraying for codling moth and apple scab. Spraying apparatus. Fertilizer experiments. Growing grains mixed and separately. Spring and fall manuring. Meteorological observations. Jamestown weed. White radish. Yellow dock. Chess. Mosses as stock food. Ticks. Sphinx moths. Cut worms. Cotton wood dagger. Three toothed Aphonus. Predaceous water beetle. Parallel elaphidion. Brown ptinus. Goldsmith beetle. Remedies for borers. Breeding statistics.

\*REPORT FOR 1892.

Inspection of fertilizers. Miscellaneous analyses. Secondary effects of Pollination. Notes on cabbages, tomatoes and egg plant. Fruit tests. Spraying experiments. Fall dandelion. Orange hawkweed. Leaf blight of pear. Black or hair mold. Anthracnose of blackberry and raspberry. Potato blight. Fall canker worm. Boll or corn worm. Chinch bug. Horn fly. Two-spotted mite. Cut worms. Meteorological observations. Testing cream and milk fat test and lactometer.

REPORT FOR 1893.

Investigation of the foraging powers of some agricultural plants for phosphoric acid. The composition of fodders and silage from the corn plant. Digestion experiments with sheep. Corn as a silage crop. Feeding experiments with cows and swine. Waste of fat in the skimmed milk by the deep-setting process. Notes on cabbages, cauliflowers, tomatoes, egg plants and potatoes. Spraying experiments. Catalogue of Maine fruits. Bean and tomato anthracnose. Potato and beet scab. The Angoumois grain moth; the lime-tree winter-moth; the apple-leaf bucculatrix; the Disippus butterfly; the May beetle; the bean weevil; the pear-blight beetle or shot-borer; the carrot-fly.

REPORT FOR 1894.

Analyses of butter and imitation butter. Field experiments with fertilizers. The profitable amount of seed per acre for corn. Digestion experiments. Feeding experiments. Notes on potatoes and corn. Notes on small fruits and on plant breeding. The orange-colored roestelia or quince rust. Diseases of oats. Night-flowering catchfly. The dichotomous catchfly. Potato scab. The snow flea. The silver fish. The ring-banded soldier-bug. The elm tree bark louse. The gooseberry plant-louse. The oblique-banded carpet beetle. The oak-bark weevil. The fall canker worm. Tuberculin as a diagnostic agent. Bulletins issued in 1894—Fruit-culture. Spraying experiments. Tomatoes. Cauliflowers. Corn as a silage crop. Potatoes. Tuberculosis and glanders. A scheme for paying for cream, etc. Foraging powers of some agricultural plants.

## REPORT FOR 1895.

Investigations on the foraging powers of some agricultural plants for phosphoric acid. The profitable amount of seed per acre for corn. Sunflower heads and blackeye peas as silage crops. Feeding experiments with milch cows. The relation of food to the growth and composition of the bodies of steers. Notes on potatoes, sweet corn, peas and cabbage. Notes on plants and insects. Second blooming of pear trees. Cattle lice. The yellow woolly bear. Tapestry moth. The strawberry leaf beetle. The cucumber flea beetle. The currant fly. Bulletins issued in 1895—Important facts about corn. Inspection of fertilizers. A discussion of certain commercial fertilizers. A discussion of condimental foods. Notes on small fruits. Inspection of fertilizers.

## REPORT FOR 1896.

New fittings of the cow stable. Analyses of feeding stuffs. Profitable amount of seed corn per acre. Sunflowers and English horse beans as silage crops. Tests of separators. Feeding experiments with milch cows. Effects of tuberculin on tuberculous cows. Orchard notes. Notes on winter gardening. Notes on plants. Insects of the year. A new garden *Smythurid*. Dietary studies at the Maine State College. Meteorological summary. Reprints of bulletins 23 to 31. Inspection laws. General index to reports for 1885 to 1895 inclusive.

## REPORT FOR 1897.

Reprints of bulletins 32 to 40. Inspections for 1897. Testing dairy products by the Babcock test. New poultry plant. Ornamenting home grounds. Acquisition of atmospheric nitrogen. Digestion experiments. Tests of tuberculin on tuberculous cows. Comparison of the temperatures of healthy and tuberculous cows. Notes on insects and plants. King-devil weed. Herd records. Meteorological observations.

## REPORT FOR 1898.

Reprint of bulletins 41 to 47. Inspections for 1898. Box experiments with phosphoric acid. Analyses of fodders and feeding stuffs. Digestion experiments with sheep. Oat hay harvested at different stages of maturity. Effect of food on the hardness of butter and composition of butter fat. Effect of feeding fat on the fat content of milk. Injurious millipedes. An injurious caddice fly. Insects and plants of the year. Tuberculosis and the station herd. Nest box for keeping individual egg records. Number of laying hens that can be profitably kept in one pen. Herd records. Comparison of large and small radish seed. Effects of subwatering radishes. Blueberry in Maine. Experiments upon the digestibility of bread. Acquisition of atmospheric nitrogen. Soil inoculation. Skimmed milk vs. water in bread making. Pollination and fertilization of flowers. Meteorological observations.

## NUMBERS AND TITLES OF BULLETINS OF THE PRESENT SERIES.

1. Analysis of Commercial Fertilizers for 1889.
2. The Apple Maggot.
- \*3. Babcock Milk Test Adapted to Testing Cream.
4. Testing Cream and Milk Fat Test and Lactometer.
5. Waste of Fat in Skimmed Milk by the Deep-setting Process.
6. Fruit Culture—Varieties.
7. Inspection of Fertilizer.
8. Spraying Experiments.
9. Tomatoes.
10. Cauliflowers.
11. Corn as a Silage Crop.
12. Potatoes.
13. Suppression of Bovine Tuberculosis and Glanders.
14. Inspection of Fertilizers.
- \*15. Paying for Cream by the Babcock Test.
16. Foraging Powers of Some Agricultural Plants for Phosphoric Acid.
17. Important Facts about Corn.
18. Inspection of Fertilizers, 1895.
19. Commercial Articles (1) Fertilizers.
20. Commercial Articles (2) Foods.
21. Notes on Small Fruits.
22. Inspection of Fertilizers.
23. Preservation of Cream for Market.
24. Cabbages.
25. Inspection of Fertilizers, 1896.
26. Inspection of Glassware used by Creameries and Butter Factories.
27. Peas—Sweet Corn.
28. Potato Rot—Bordeaux Mixture and Fungicoid.
29. Notes on Spraying.
30. Fertilizer Inspection.
- \*31. Modification of Babcock Method.
32. Three Troublesome Weeds.
33. Fertilizer Inspection.
- \*34. Box Experiments with Phosphates.
35. The Currant Fly.
36. Testing Seeds.
37. Feeding Stuff Inspection.
38. Fertilizer Inspection.
39. Stock Feeding Suggestions.
40. Celery.
41. Dehorning Cows.
- \*42. Ornamenting Home Grounds.
43. Fertilizer Inspection.
44. Feeding Stuff Inspection.
45. Fertilizer Inspection.
46. Ornamental Plants for Maine.

47. Wheat Offals Sold in Maine in 1898.
48. Feeding Stuff Inspection.
49. Care of Orchards.
50. Fertilizer Inspection.
51. Feeding Stuff Inspection.
52. The Spraying of Plants.
53. Fertilizer Inspection.
54. Nuts as Food.
55. Cereal Breakfast Foods.
56. Apple Insects of Maine.
57. Experiments With Potatoes.
58. Finances, Meteorology, Index.
59. Feeding Stuff Inspection.
60. Fertilizer Inspection.
61. Notes on Insects and Plants.

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## FEEDING STUFF INSPECTION.

CHAS. D. WOODS, Director.

J. M. BARTLETT, chemist in charge of inspection analyses.

### CHIEF REQUIREMENTS OF THE LAW.

The points of the law of most interest to dealer and consumer are:

*Kinds of Feed coming within the Law.* The law applies to all feeding stuffs except hays and straws; whole seeds and meals of wheat, rye, barley, oats, Indian corn, buckwheat and broom corn; wheat, buckwheat and rye brans or middlings *not mixed with other substances*, but sold separately, as distinct articles of commerce.\*

*Inspection tax and tag.* To meet the expenses of inspection, a tax of ten cents per ton must be paid to the Director of the Maine Agricultural Experiment Station who is required to furnish a tag stating that all charges have been paid. This tag, which bears the Director's signature, shows that the tax has been paid but is *not a guarantee of the quality of the goods*.

*The brand.* Each package of feeding stuff included within the law shall have affixed the inspection tax tag and shall also bear, conspicuously printed; the number of net pounds contained in the package, the name or trade mark under which it is sold, the name of the manufacturer or shipper, the place of manufacture, the place of business or manufacture or shipper, the percentage of crude protein, the percentage of crude fat. These statements may be printed directly on the bag, on a tag attached to the package, or on the back of the inspection tax tag furnished by the Director of the Station. The quality of the goods is guaranteed by the manufacturer, importer or dealer, *and not by the Station*. The samples collected and analyzed by the Station show whether the goods are up to guarantee or not.

The goods must carry the inspection tax tag and the brand before they can be legally offered for sale in the State. It will not answer to affix tags at the time the goods are sold.

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\*All milling offals except bran or middlings come under the requirement of the law. See page 88 of this Bulletin.

## MANUFACTURERS AND PLACE OF SAMPLING.

Station number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8848	Chapin & Co .....	St. Louis, Mo. ....	Rumford Falls .....
8874	Chapin & Co .....	St. Louis, Mo. ....	Bangor .....
8881	Chapin & Co .....	St. Louis, Mo. ....	Bangor .....
8893	Chapin & Co .....	St. Louis, Mo. ....	Bangor .....
8906	Chapin & Co .....	St. Louis, Mo. ....	Portland .....
8907	Chapin & Co .....	St. Louis, Mo. ....	Portland .....
8908	Chapin & Co .....	St. Louis, Mo. ....	Saco .....
8909	Chapin & Co .....	St. Louis, Mo. ....	Yarmouth .....
8910	Chapin & Co .....	St. Louis, Mo. ....	Westbrook .....
8944	Chapin & Co .....	St. Louis, Mo. ....	Brunswick .....
8945	Chapin & Co .....	St. Louis, Mo. ....	Freeport .....
8979	Chapin & Co .....	St. Louis, Mo. ....	Auburn .....
8980	Chapin & Co .....	St. Louis, Mo. ....	Lewiston .....
8981	Chapin & Co .....	St. Louis, Mo. ....	Augusta .....
8982	Chapin & Co .....	St. Louis, Mo. ....	Richmond .....
8983	Chapin & Co .....	St. Louis, Mo. ....	Pittsfield .....
8987	The American Cotton Oil Co ...	Memphis, Tenn*...	Camden .....
8940	The American Cotton Oil Co ...	Memphis, Tenn*...	Fryeburg .....
8939	The American Cotton Oil Co ...	Little Rock, Ark...	Brunswick .....
8938	The American Cotton Oil Co ...	Jackson, Tenn .....	Hiram .....
9042	The American Cotton Oil Co ...	Jackson, Tenn .....	Corinna .....
8901	F. W. Brod� & Co .....	Memphis, Tenn...	Stroudwater ... ..
8994	F. W. Brod� & Co .....	Memphis, Tenn...	Auburn .....
8995	F. W. Brod� & Co .....	Memphis, Tenn ..	Pittsfield .....
9041	F. W. Brod� & Co .....	Memphis, Tenn...	Foxcroft .....
8900	E. B. Williams & Co .....	Memphis, Tenn...	Portland .....
8941	E. B. Williams & Co .....	Memphis, Tenn...	Bridgeport .....
8942	E. B. Williams & Co .....	Memphis, Tenn...	Fryeburg .....
8943	E. B. Williams & Co .....	Memphis, Tenn...	Brownfield .....
8988	E. B. Williams & Co .....	Memphis, Tenn...	Bowdoinham .....
8989	E. B. Williams & Co .....	Memphis, Tenn...	Lewiston .....
8990	E. B. Williams & Co .....	Memphis, Tenn...	South Paris .....
8991	E. B. Williams & Co .....	Memphis, Tenn...	Newport .....
8992	E. B. Williams & Co .....	Memphis, Tenn...	Norway .....
9038	E. B. Williams & Co .....	Memphis, Tenn...	Skowhegan .....
9039	E. B. Williams & Co .....	Memphis, Tenn...	Hampden .....
8866	S. A. & J. H. True Co. ....	.....	Boothbay .....
8872	S. A. & J. H. True Co. ....	.....	Portland .....
8880	S. A. & J. H. True Co. ....	.....	Portland .....
8902	S. A. & J. H. True Co. ....	.....	Portland .....
8899	The Southern Cotton Oil Co ...	.....	Biddeford .....
8978	The Southern Cotton Oil Co ...	.....	Augusta .....
8917	Butler Breed Co. ....	.....	Saco .....
8946	Paris Flouring Co .....	Memphis, Tenn...	Freeport .....
8947	Humphreys, Goodwin & Co ...	Memphis, Tenn...	South Windham ..
8993	Humphreys, Goodwin & Co ...	Memphis, Tenn...	Auburn ..
8984	J. E. Soper & Co .....	.....	Lewiston ..
8985	J. E. Soper & Co .....	.....	Bowdoinham .....

\* Hanover Mill.

## ANALYSES OF SAMPLES.

Name of Feed.	PROTEIN.		FAT.		Station number.
	Found — per cent.	Guaranteed — per cent.	Found — per cent.	Guaranteed — per cent.	
Cotton Seed Meal .....	46.50	43.00	*	9.00	8848
Cotton Seed Meal .....	45.38	43.00	8.95	9.00	8874
Cotton Seed Meal .....	45.50	43.00	9.21	9.00	8881
Cotton Seed Meal .....	43.56	43.00	12.12	9.00	8893
Cotton Seed Meal .....	45.69	43.00	9.77	9.00	8906
Cotton Seed Meal .....	41.69	43.00	16.52	9.00	8907
Cotton Seed Meal .....	43.06	43.00	12.40	9.00	8908
Cotton Seed Meal .....	43.94	43.00	12.26	9.00	8909
Cotton Seed Meal .....	42.56	43.00	14.53	9.00	8910
Cotton Seed Meal .....	45.50	43.00	9.84	9.00	8944
Cotton Seed Meal .....	44.50	43.00	11.74	9.00	8945
Cotton Seed Meal .....	47.63	43.00	10.69	9.00	8979
Cotton Seed Meal .....	46.94	43.00	10.14	9.00	8980
Cotton Seed Meal .....	47.38	43.00	10.06	9.00	8981
Cotton Seed Meal .....	43.81	43.00	12.21	9.00	8982
Cotton Seed Meal .....	47.75	43.00	9.32	9.00	8983
Prime Cotton Seed Meal .....	45.31	43.00	12.03	9.00	8987
Prime Cotton Seed Meal .....	43.44	45.00	10.60	9.00	8940
Prime Cotton Seed Meal .....	43.38	43.00	9.80	9.00	8939
Prime Cotton Seed Meal .....	47.25	43.00	8.48	9.00	8938
Prime Cotton Seed Meal .....	47.63	43.00	9.17	9.00	9042
Owl Brand Pure Cotton Seed Meal .....	46.19	43.00	14.34	9.00	8901
Owl Brand Pure Cotton Seed Meal .....	48.94	43.00	10.99	9.00	8904
Owl Brand Pure Cotton Seed Meal .....	47.81	43.00	9.04	9.00	8995
Owl Brand Pure Cotton Seed Meal .....	49.13	43.00	11.13	9.00	9041
Daisy Brand Cotton Seed Meal .....	46.00	43.00	12.11	9.00	8900
Daisy Brand Cotton Seed Meal .....	46.69	43.00	8.34	9.00	8941
Daisy Brand Cotton Seed Meal .....	44.19	43.00	8.68	9.00	8942
Daisy Brand Cotton Seed Meal .....	47.31	43.00	9.11	9.00	8943
Daisy Brand Cotton Seed Meal .....	45.44	43.00	12.17	9.00	8988
Daisy Brand Cotton Seed Meal .....	45.75	43.00	8.68	9.00	8989
Daisy Brand Cotton Seed Meal .....	47.38	43.00	8.75	9.00	8990
Daisy Brand Cotton Seed Meal .....	46.75	43.00	8.39	9.00	8991
Daisy Brand Cotton Seed Meal .....	47.69	43.00	9.71	9.00	8992
Daisy Brand Cotton Seed Meal .....	44.44	43.00	12.57	9.00	9038
Daisy Brand Cotton Seed Meal .....	44.56	43.00	8.21	9.00	9039
Prime Cotton Seed Meal .....	23.50	43.00	8.11	9.00	8866
Prime Cotton Seed Meal .....	24.25	43.00	8.03	9.00	8872
Prime Cotton Seed Meal .....	25.63	43.00	7.54	9.00	8880
Prime Cotton Seed Meal .....	22.19	43.00	7.14	9.00	8902
Prime Finely Ground Cotton Seed Meal .....	47.25	43.00	9.28	9.00	8899
Prime Finely Ground Cotton Seed Meal .....	46.19	43.00	10.17	9.00	8978
Cotton Seed Meal .....	45.50	43.00	11.30	9.00	8917
Prime Memphis Cotton Seed Meal .....	45.38	43.00	10.12	9.00	8946
Dixie Brand Cotton Seed Meal .....	44.75	43.00	8.33	9.00	8947
Dixie Brand Cotton Seed Meal .....	44.13	43.00	9.67	9.00	8993
Cotton Seed Meal .....	44.25	43.00	9.14	9.00	8984
Cotton Seed Meal .....	44.13	43.00	12.72	9.00	8985

\* Not determined.

## MANUFACTURERS—Continued.

Station number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8986	J. E. Soper & Co .....	.....	Norway .....
8987	J. E. Soper & Co .....	.....	Richmond .....
9040	J. E. Soper & Co .....	.....	Winterport .....
8904	J. E. Soper & Co .....	.....	Saco .....
8905	J. E. Soper & Co .....	.....	Portland .....
8850	.....	.....	Palmyra .....
8996	.....	.....	Pittsfield .....
8871	S. W. Hamilton .....	.....	Cumberland Junc. .....
8903	Matthews & Houston .....	.....	Portland .....
8916	S. A. & J. H. True Co .....	.....	Biddeford .....
8856	The Glucose Sugar Refining Co. ....	.....	Pittsfield .....
8857	The Glucose Sugar Refining Co. ....	.....	Portland .....
8861	The Glucose Sugar Refining Co. ....	.....	Portland .....
8862	The Glucose Sugar Refining Co. ....	.....	Portland .....
8875	The Glucose Sugar Refining Co. ....	.....	Bangor .....
8876	The Glucose Sugar Refining Co. ....	.....	South Brewer .....
8882	The Glucose Sugar Refining Co. ....	.....	Bangor .....
8888	The Glucose Sugar Refining Co. ....	.....	Bangor .....
8884	The Glucose Sugar Refining Co. ....	.....	Bangor .....
8914	The Glucose Sugar Refining Co. ....	.....	Biddeford .....
8948	The Glucose Sugar Refining Co. ....	.....	Hiram .....
8949	The Glucose Sugar Refining Co. ....	.....	Rockland .....
8950	The Glucose Sugar Refining Co. ....	.....	Camden .....
8951	The Glucose Sugar Refining Co. ....	.....	Bridgton .....
8932	The Glucose Sugar Refining Co. ....	.....	Brownfield .....
9000	The Glucose Sugar Refining Co. ....	.....	Auburn .....
9002	The Glucose Sugar Refining Co. ....	.....	Auburn .....
9045	The Glucose Sugar Refining Co. ....	.....	Winterport .....
8913	The Glucose Sugar Refining Co. ....	.....	Saco .....
8892	The Glucose Sugar Refining Co. ....	.....	Oldtown .....
8998	The Glucose Sugar Refining Co. ....	.....	Pittsfield .....
8999	The Glucose Sugar Refining Co. ....	.....	Lewiston .....
8997	The Glucose Sugar Refining Co. ....	.....	Augusta .....
9001	The Glucose Sugar Refining Co. ....	.....	Auburn .....
8911	Charles Pope Glucose Co .....	.....	Saco .....
8912	Charles Pope Glucose Co .....	.....	Stroudwater .....
8953	Charles Pope Glucose Co .....	.....	Bath .....
8954	Charles Pope Glucose Co .....	.....	Brunswick .....
9003	Charles Pope Glucose Co .....	.....	Auburn .....
9004	Charles Pope Glucose Co .....	.....	Lewiston .....
8915	National Starch Manf'g Co. ....	Des Moines, Iowa ..	Portland .....
8955	National Starch Manf'g Co. ....	Des Moines, Iowa ..	Freeport .....
8956	National Starch Manf'g Co. ....	Des Moines, Iowa ..	South Windham ..
9005	National Starch Manf'g Co. ....	Des Moines, Iowa ..	Richmond .....
9006	National Starch Manf'g Co. ....	Des Moines, Iowa ..	Auburn .....
9007	National Starch Manf'g Co. ....	Des Moines, Iowa ..	Norway .....
9008	National Starch Manf'g Co. ....	Des Moines, Iowa ..	Lewiston .....
9009	National Starch Manf'g Co. ....	Des Moines, Iowa ..	Monmouth .....

## ANALYSES—Continued.

Name of Feed.	PROTEIN.		FAT.		Station number.
	Found— per cent.	Guaranteed per cent.	Found— per cent.	Guaranteed per cent.	
Cotton Seed Meal .....	44.13	43.00	10.32	9.00	8986
Cotton Seed Meal .....	42.50	43.00	8.69	9.00	8987
Cotton Seed Meal .....	44.50	43.00	10.64	9.00	9040
Cotton Seed Meal .....	45.19	43.00	9.80	9.00	8904
Cotton Seed Meal .....	44.50	43.00	9.03	9.00	8905
Cotton Seed Meal .....	45.44	No guar.	14.05	No guar.	8850
Cotton Seed Meal .....	45.06	No guar.	12.37	No guar.	8996
Cotton Seed Meal .....	27.13	No guar.	*	No guar.	8871
Sea Island Cotton Seed Meal .....	25.44	No guar.	6.91	No guar.	8903
Cotton Seed Meal .....	23.63	No guar.	7.99	No guar.	8916
Chicago Gluten Meal .....	34.19	38.00	3.87	2.00	8856
Chicago Gluten Meal .....	38.56	38.00	3.44	2.00	8857
Chicago Gluten Meal .....	39.38	38.00	3.05	2.00	8861
Chicago Gluten Meal .....	39.56	38.00	2.68	2.00	8862
Chicago Gluten Meal .....	34.50	38.00	4.61	2.00	8875
Chicago Gluten Meal .....	33.25	38.00	4.33	2.00	8876
Chicago Gluten Meal .....	35.38	38.00	4.48	2.00	8882
Chicago Gluten Meal .....	33.38	38.00	3.88	2.00	8883
Chicago Gluten Meal .....	35.81	38.00	4.16	2.00	8884
Chicago Gluten Meal .....	39.13	38.00	2.58	2.00	8914
Chicago Gluten Meal .....	34.25	38.00	4.49	2.00	8948
Chicago Gluten Meal .....	39.75	38.00	3.32	2.00	8949
Chicago Gluten Meal .....	34.25	38.00	4.61	2.00	8950
Chicago Gluten Meal .....	33.63	38.00	4.83	2.00	8951
Chicago Gluten Meal .....	34.13	38.00	3.73	2.00	8952
Chicago Gluten Meal .....	33.88	38.00	4.51	2.00	9000
Chicago Gluten Meal .....	34.88	38.00	3.38	2.00	9002
Chicago Gluten Meal .....	38.31	38.00	3.04	2.00	9045
Chicago Gluten Meal .....	32.94	38.00	4.14	2.00	8913
Chicago Gluten Meal .....	33.19	34.20	3.58	3.75	8892
Chicago Gluten Meal .....	34.06	34.20	3.61	3.75	8998
Chicago Gluten Meal .....	38.00	34.20	3.74	3.75	8999
Chicago Gluten Meal .....	36.88	36.00	2.88	3.37	8997
Chicago Gluten Meal .....	36.31	36.00	4.36	3.37	9001
Cream Gluten Meal .....	32.63	34.12	3.29	3.20	8911
Cream Gluten Meal .....	34.19	34.12	2.57	3.20	8912
Cream Gluten Meal .....	33.00	34.12	1.37	3.20	8953
Cream Gluten Meal .....	32.13	34.12	1.64	3.20	8954
Cream Gluten Meal .....	32.13	34.12	1.13	3.20	9003
Cream Gluten Meal .....	32.69	34.12	2.58	3.20	9004
King Gluten Meal .....	31.06	32.00	12.39	16.00	8915
King Gluten Meal .....	31.50	32.00	10.73	16.00	8955
King Gluten Meal .....	35.69	32.00	2.04	16.00	8956
King Gluten Meal .....	30.44	32.00	3.13	16.00	9005
King Gluten Meal .....	33.94	32.00	2.37	16.00	9006
King Gluten Meal .....	36.50	32.00	2.31	16.00	9007
King Gluten Meal .....	38.44	32.00	2.86	16.00	9008
King Gluten Meal .....	34.94	32.00	3.22	16.00	9009

\* Not determined.

## MANUFACTURERS—Continued.

Station number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8044	National Starch Man'g Co ....	Des Moines, Iowa..	Corinna .....
8851	The Glucose Sugar Refining Co.	Rockford, Ill .....	Bangor .....
8852	C. B. Cummings & Son .....		Norway .....
8848	Manger L. O. Co .....	Toledo, Ohio .....	Orono .....
8860	S. A. & J. H. True Co .....		Portland .....
8860	S. A. & J. H. True Co .....		Bridgton .....
8958	Mayflower Mills .....	Fort Wayne, Ind ..	Bath .....
8959	American Linseed Co .....	South Chicago, Ill..	Fryeburg .....
8967	The Cleveland Linseed Oil Co..		Rockland .....
9013	The Cleveland Linseed Oil Co..		Winthrop .....
9014	The Cleveland Linseed Oil Co..		Norway .....
9015	The Cleveland Linseed Oil Co..		Lewiston .....
9010	Not named .....		Newport .....
9011	Not named .....		Monmouth .....
9043	Not named .....		Skowhegan .....
9012	Not named .....		Auburn .....
8855	The American Cereal Co .....	Chicago, Ill .....	Bangor .....
8918	The American Cereal Co .....	Chicago, Ill .....	Portland .....
8919	The American Cereal Co .....	Chicago, Ill .....	Portland .....
8920	The American Cereal Co .....	Chicago, Ill .....	Saco .....
8961	The American Cereal Co .....	Chicago, Ill .....	Fryeburg .....
8962	The American Cereal Co .....	Chicago, Ill .....	South Windham ..
9018	The American Cereal Co .....	Chicago, Ill .....	Richmond .....
9019	The American Cereal Co .....	Chicago, Ill .....	Bethel .....
9020	The American Cereal Co .....	Chicago, Ill .....	Lewiston .....
9046	The American Cereal Co .....	Chicago, Ill .....	Skowhegan .....
9047	The American Cereal Co .....	Chicago, Ill .....	Belfast .....
8891	The H-O Co .....	Buffalo, N. Y .....	Oldtown .....
8925	Dock & Coal Co. ....	Plattsburgh, N. Y..	Portland .....
8926	S. A. & J. H. True Co .....		Portland .....
8894	Not named .....		Oldtown .....
8922	The American Cereal Co .....	Chicago, Ill .....	Portland .....
8974	The American Cereal Co .....	Chicago, Ill .....	Readfield Depot...
8924	W. H. Haskell & Co. ....	Toledo, Ohio .....	Portland .....
8969	The H-O Co .....	Buffalo, N. Y .....	Greenville .....
8921	The American Cereal Co .....	Chicago, Ill .....	Westbrook .....
8963	The American Cereal Co .....	Chicago, Ill .....	Brunswick .....
8964	The American Cereal Co .....	Chicago, Ill .....	South Windham ..
8965	The American Cereal Co .....	Chicago, Ill .....	Brownfield .....
8921	The American Cereal Co .....	Chicago, Ill .....	Richmond .....
8948	The American Cereal Co .....	Chicago, Ill .....	Waterville .....
8860	The American Cereal Co .....	Chicago, Ill .....	Bangor .....
8926	The American Cereal Co .....	Chicago, Ill .....	Yarmouth .....
8928	Not named .....		Yarmouth .....
8847	Not named .....		Rumford Falls .....
8876	Not named .....		Orono .....
8887	Not named .....		Bangor .....
8888	Not named .....		Bucksport .....

## ANALYSES—Continued.

Name of Feed.	PROTEIN.		FAT.		Station number.
	Found— per cent.	Guaranteed per cent.	Found— per cent.	Guaranteed per cent.	
King Gluten Meal.....	37.06	32.00	2.85	16.00	9044
Diamond Gluten Feed.....	26.25	26.20	2.47	2.70	8851
Gluten Feed.....	27.19	26.00	4.13	4.00	8852
Linseed Oil Meal.....	35.38	39.00	7.56	1.50	8849
Linseed Oil Meal.....	29.94	30.00	6.94	7.00	8930
Linseed Oil Meal.....	32.56	36.94	6.15	6.58	8960
Old Process Oil Meal.....	18.88	19.00	6.95	7.00	8958
Linseed Meal.....	38.69	38.00	2.90	3.00	8959
Cleveland Flax Meal.....	38.50	39.00	2.68	1.50	8957
Cleveland Linseed Oil Meal.....	36.75	39.00	2.87	1.50	9013
Cleveland Linseed Oil Meal.....	39.69	39.00	2.23	1.50	9014
Cleveland Linseed Oil Meal.....	36.88	39.00	2.59	1.50	9015
Linseed Oil Meal.....	37.69	38.00	2.63	1.00	9010
Linseed Oil Meal.....	37.56	38.00	2.57	1.00	9011
Linseed Oil Meal.....	37.50	38.00	2.71	1.00	9043
Linseed Oil Meal.....	39.00	No guar.	2.83	No guar.	9012
Victor Corn and Oat Feed.....	8.19	9.46	3.28	3.92	8885
Victor Corn and Oat Feed.....	8.19	9.46	3.14	3.42	8918
Victor Corn and Oat Feed.....	9.19	9.46	4.67	3.42	8919
Victor Corn and Oat Feed.....	8.44	9.46	4.03	3.42	8920
Victor Corn and Oat Feed.....	9.44	9.46	3.42	3.92	8961
Victor Corn and Oat Feed.....	8.50	8.23	3.10	3.00	8962
Victor Corn and Oat Feed.....	9.19	8.23	4.07	3.00	9018
Victor Corn and Oat Feed.....	8.88	8.23	3.43	3.00	9019
Victor Corn and Oat Feed.....	8.13	9.46	3.08	3.92	9020
Victor Corn and Oat Feed.....	9.75	9.46	4.60	3.92	9046
Victor Corn and Oat Feed.....	9.25	8.23	4.20	3.00	9047
H-O Co.'s Dundee Corn and Oat Feed..	8.13	8.38	2.70	2.95	8891
Dandy Corn and Oat Feed.....	9.13	No guar.	4.77	No guar.	8925
Corn and Oat Feed.....	7.50	9.63	3.27	4.23	8926
Oat Chop.....	9.13	8.00	4.55	5.00	8894
Quaker Oat Feed.....	13.38	12.03	3.11	3.49	8922
Quaker Oat Feed.....	10.06	12.03	2.68	3.49	8974
Oat Feed.....	9.50	9.62	4.82	7.60	8924
The H-O Co.'s Dairy Feed.....	16.63	18.00	4.82	4.50	8869
Quaker Dairy Feed.....	14.36	12.03	3.67	3.49	8921
Quaker Dairy Feed.....	14.00	12.03	3.09	2.50	8963
Quaker Dairy Feed.....	14.38	12.03	2.79	2.50	8964
Quaker Dairy Feed.....	13.00	12.03	2.91	3.49	8965
Quaker Dairy Feed.....	13.31	12.03	3.34	3.49	9021
Quaker Dairy Feed.....	14.50	12.03	4.12	2.50	9048
American Poultry Food.....	12.69	No guar.	5.52	No guar.	8890
American Poultry Food.....	13.69	13.96	6.22	5.49	8923
Rice Feed.....	8.75	No guar.	9.03	No guar.	8928
Purity Mixed Feed.....	11.50	No guar.	*	No guar.	8847
Purity Mixed Feed.....	10.63	No guar.	*	No guar.	8870
Purity Mixed Feed.....	12.88	No guar.	4.42	No guar.	8887
Purity Mixed Feed.....	10.56	No guar.	3.80	No guar.	8888

\* Not determined.

## MANUFACTURERS—Concluded.

Station number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8927	Not named .....	.....	Portland .....
8936	Not named .....	.....	Winthrop .....
8969	Not named .....	.....	Brunswick .....
8970	Not named .....	.....	Brunswick .....
8973	Not named .....	.....	Readfield Depot...
9023	Not named .....	.....	Newport .....
9024	Not named .....	.....	Winthrop .....
9025	Not named .....	.....	Lewiston .....
9049	Not named .....	.....	Foxcroft .....
8877	The Doten Grain Co. ....	.....	South Brewer .....
8878	The Doten Grain Co. ....	.....	Bangor .....
8929	The Doten Grain Co. ....	.....	Biddeford .....
8966	The Doten Grain Co. ....	.....	Hiram .....
8967	The Doten Grain Co. ....	.....	South Windham ...
8968	The Doten Grain Co. ....	.....	Freeport .....
8886	Not named .....	.....	Bangor .....
8971	Not named .....	.....	Fryeburg .....
9027	Not named .....	.....	Norway .....
9028	Not named .....	.....	Bethel .....
9026	Not named .....	.....	South Paris .....
8889	The Bowker Co. ....	Boston, Mass .....	Bangor .....
8932	The Bowker Co. ....	Boston, Mass .....	Portland .....
8933	The Bowker Co. ....	Boston, Mass .....	Portland .....
9016	The Bowker Co. ....	Boston, Mass .....	Norway .....
8931	Bradley Fertilizer Co. ...	Boston, Mass .....	Portland .....
8934	N. W. Fertilizer Co. ....	Chicago, Ill .....	Portland .....
8935	The Armour Fertilizer Works..	Chicago, Ill .....	Portland .....
9017	Sagadahoc Fertilizer Co .....	Bowdoinham .....	Bowdoinham .....

## ANALYSES—Concluded.

Name of Feed.	PROTEIN.		FAT.		Station number.
	Found— per cent.	Guaranteed per cent.	Found— per cent.	Guaranteed per cent.	
Purity Mixed Feed .....	10.88	No guar.	3.51	No guar.	8927
Purity Mixed Feed .....	11.13	No guar.	3.62	No guar.	8936
Purity Mixed Feed .....	12.63	No guar.	4.15	No guar.	8969
Purity Mixed Feed .....	12.25	No guar.	4.16	No guar.	8970
Purity Mixed Feed .....	12.19	No guar.	3.14	No guar.	8973
Purity Mixed Feed .....	12.63	No guar.	3.93	No guar.	9023
Purity Mixed Feed .....	12.63	No guar.	4.14	No guar.	9024
Purity Mixed Feed .....	12.75	No guar.	3.98	No guar.	9025
Purity Mixed Feed .....	12.13	No guar.	4.45	No guar.	9049
Crown Fancy Winter Wh't Mixed Feed	12.13	No guar.	4.48	No guar.	8877
Crown Fancy Winter Wh't Mixed Feed	12.25	No guar.	3.81	No guar.	8878
Crown Fancy Winter Wh't Mixed Feed	12.19	No guar.	4.19	No guar.	8929
Crown Fancy Winter Wh't Mixed Feed	12.00	No guar.	3.22	No guar.	8966
Crown Fancy Winter Wh't Mixed Feed	12.06	No guar.	4.02	No guar.	8967
Crown Fancy Winter Wh't Mixed Feed	11.44	No guar.	3.98	No guar.	8968
Kentucky Mixed Feed.....	9.13	11.00	4.28	No guar.	8886
Kentucky Mixed Feed.....	13.50	No guar.	4.08	No guar.	8971
Kentucky Mixed Feed.....	11.88	No guar.	3.25	No guar.	9027
Kentucky Mixed Feed.....	13.00	No guar.	3.58	No guar.	9028
Mixed Feed. . . . .	12.50	No guar.	3.52	No guar.	9026
Bowker's Animal Meal.....	39.75	30.00	10.63	5.00	8889
Bowker's Animal Meal.....	47.63	30.00	9.10	5.00	8932
Bowker's Beef Scraps .....	48.56	30.00	16.95	20.00	8933
Bowker's Ground Beef Scraps .....	56.00	60.00	18.94	14.00	9016
Bradley's Superior Meat Meal. ....	48.75	40.00	9.93	15.00	8931
Horse Shoe Brand Gr'd Beef Cracklings	64.63	60.00	18.26	16.00	8934
Meat Meal for Poultry.....	58.88	60.00	17.60	16.00	8935
Raw Ground Bone Meal .....	27.94	18.75	2.44	No guar.	9017

## SUMMARY OF ANALYSES.

	Number of analyses.		PROTEIN.		FAT.	
			Found— per cent.	Guaranteed— per cent.	Found— per cent.	Guaranteed— per cent.
Chapin & Co.'s Cotton Seed Meal.	16	Highest Lowest Average	47.75 41.69 45.09	..... 43.00 .....	16.52 8.95 11.32	9.00
The American Cotton Oil Co.'s Prime Cotton Seed Meal.	5	Highest Lowest Average	47.63 43.38 45.40	..... 43.00 .....	12.03 8.48 10.02	9.00
F. W. Brod� & Co.'s Owl Brand Pure Cotton Seed Meal.	4	Highest Lowest Average	49.13 46.19 48.02	..... 43.00 .....	14.34 9.04 11.37	9.00
E. B. Williams & Co.'s Daisy Brand Cotton Seed Meal.	11	Highest Lowest Average	47.69 44.19 46.11	..... 43.00 .....	12.57 8.21 9.71	9.00
The Southern Cotton Oil Co.'s Prime Finely Ground Cotton Seed Meal.	2	Highest Lowest Average	47.25 46.19 46.72	..... 43.00 .....	10.17 9.28 9.73	9.00
Butler Breed Co.'s Cotton Seed Meal.	1	....	45.50	43.00	11.30	9.00
Paris Flouring Co.'s Prime Memphis Cotton Seed Meal.	1	.....	45.38	43.00	10.12	9.00
Humphreys, Goodwin & Co.'s Dixie Brand Cotton Seed Meal.	2	Highest Lowest Average	44.75 44.13 44.44	..... 43.00 .....	9.67 8.33 9.00	9.00
J. E. Soper & Co.'s Cotton Seed Meal.	7	Highest Lowest Average	45.19 42.50 44.17	..... 43.00 .....	12.72 8.69 10.05	9.00
Manufacturer unknown Cotton Seed Meal.	2	Highest Lowest Average	45.44 45.06 45.25	..... ..... .....	14.05 12.37 13.21	
S. A. & J. H. True Co.'s Prime Cotton Seed Meal.	4	Highest Lowest Average	25.63 22.19 23.89	..... 43.00 .....	8.11 7.14 7.71	9.00
Manufacturer unknown Cotton Seed Meal.	3	Highest Lowest Average	27.13 25.63 25.40	..... ..... .....	7.99 6.91 7.45	
The Glucose Sugar Refin'g Co.'s Chicago Gluten Meal.	24	Highest Lowest Average	39.75 32.94 35.73	38.60 34.2 .....	4.83 2.58 3.80	3.75 2.00
Chas. Pope Glucose Co.'s Cream Gluten Meal.	6	Highest Lowest Average	34.19 32.13 32.78	..... 34.12 .....	3.29 1.13 2.10	3.20
National Starch Manf'g Co.'s King Gluten Meal.	9	Highest Lowest Average	38.44 30.44 34.46	..... 32.00 .....	12.39 2.04 4.65	16.00

## SUMMARY OF ANALYSES—Continued.

	Number of analyses.		PROTEIN.		FAT.	
			Found— per cent.	Guaranteed— per cent.	Found— per cent.	Guaranteed— per cent.
The Glucose Sugar Refin'g Co.'s Diamond Gluten Feed.	1	.....	26.25	26.20	2.47	2.70
C. B. Cummins & Son's Gluten Feed.	1	.....	27.19	26.00	4.13	4.00
Manger L. O. Co.'s Linseed Oil Meal.	1	.....	35.38	39.00	7.65	1.50
S. A. & J. H. True Co.'s Linseed Oil Meal.	1	.....	29.94	30.00	6.94	7.00
S. A. & J. H. True Co.'s Linseed Oil Meal.	1	.....	32.56	36.94	6.15	6.58
Mayflower Mills' Oil Process Oil Meal.	1	.....	18.88	19.00	6.95	7.00
The American Linseed Co.'s Linseed Meal.	1	.. .....	38.69	38.00	2.90	3.00
The Cleveland Linseed Oil Co.'s Cleveland Flax Meal.	1		38.50	39.00	2.68	1.50
Cleveland Linseed Oil Co.'s Cleveland Linseed Oil Meal.	3	Highest Lowest Average	39.69 36.75 37.77	..... 39.00 .....	2.87 2.23 2.56	1.50
Manufacturer Unknown Linseed Oil Meal.	3	Highest Lowest Average	37.69 37.50 37.58	..... 38.00 .....	2.71 2.57 2.64	1.00
Manufacturer Unknown Unguaranteed Linseed Oil Meal.	1	.....	39.00	.....	2.83	
The American Cereal Co.'s Victor Corn and Oat Feed.	11	Highest Lowest Average	9.75 8.13 8.83	9.46 8.23 .....	4.67 3.08 3.73	3.92 3.00
The H-O Co.'s Dundee Corn and Oat Feed.	1	....	8.13	8.38	2.70	2.95
Dock & Coal Co.'s Dandy Corn and Oat Feed.	1	.....	9.13	.....	4.77	
S. A. & J. H. True Co.'s Corn and Oat Feed.	1	.....	7.50	9.63	3.27	.23
Manufacturer Unknown Oat Crop.	1	.....	9.13	8.00	4.55	5.00
The American Cereal Co.'s Quaker Oat Feed.	2	Highest Lowest Average	13.38 10.06 11.72	..... 12.03 .....	3.11 2.68 2.89	3.49
W. H. Haskell & Co.'s Oat Feed.	1	.....	9.50	9.62	4.82	7.60
The H-O Co.'s Dairy Feed.	1	.....	16.63	18.00	4.82	4.50

## SUMMARY OF ANALYSES—Concluded.

	Number of analyses.		PROTEIN.		FAT.	
			Found— per cent.	Guaranteed— per cent.	Found— per cent.	Guaranteed— per cent.
The American Cereal Co.'s Quaker Dairy Feed.	6	Highest Lowest Average	14.50 13.00 13.92	..... 12.03 .....	4.12 2.79 3.32	3.49 2.50
The American Cereal Co.'s American Poultry Food.	2	Highest Lowest Average	13.69 12.69 13.19	..... 13.96 .....	6.22 5.52 5.87	5.49
Manufacturer Unknown Rice Feed.	1	... ..	8.75	.....	9.03	
Manufacturer Unknown Purity Mixed Feed.	13	Highest Lowest Average	12.75 10.56 11.90	..... ..... .....	4.45 3.14 3.94	
The Doten Grain Co.'s Crown Fancy Winter Wheat Mixed Feed.	6	Highest Lowest Average	12.25 11.44 12.01	..... ..... .....	4.48 3.22 3.95	
Manufacturer Unknown Kentucky Mixed Feed.	4	Highest Lowest Average	13.50 9.13 11.88	..... 11.00 .....	4.28 3.25 3.80	
Manufacturer Unknown Mixed Feed.	1	.....	12.50	.....	3.52	
The Bowker Co.'s Bowker's Animal Meal.	2	Highest Lowest Average	47.63 39.75 43.69	..... 30.00 .....	10.63 9.10 9.87	5.00
The Bowker Co.'s Bowker's Beef Scraps.	1	.....	48.56	30.00	16.95	20
The Bowker Co.'s Bowker's Ground Beef Scraps.	1	.....	56.00	60.00	18.94	14.00
Bradley Fertilizer Co.'s Bradley's Superior Meat Meal	1	.....	48.75	40.00	9.93	15.00
N. W. Fertilizer Co.'s Horse Shoe Brand Ground Beef Cracklings.	1	.....	64.63	60.00	18.26	16.00
The Armour Fertilizer Co.'s Meat Meal for Poultry.	1	.....	58.88	60.00	17.60	16.00
Sagadahoc Fertilizer Co.'s Raw Ground Bone Meal.	1	.....	27.94	18.75	2.44	

## VIOLATION OF THE LAW.

Two samples of high grade *unguaranteed* cottonseed meal are reported. Sample 8850 was sent by a correspondent and 8896 was taken by the inspector. Both samples came from the same car. The violation was reported to the Secretary of Agriculture.

Seven samples of low grade cottonseed meal are reported. Samples 8866, 8872, 8880 and 8902, bearing the guarantee of S. A. & J. H. True Company, were, in accordance with the statement of that firm, all from one car. Three of the four samples were from correspondents and the other was drawn by the inspector. The violation was reported to the Secretary of Agriculture. The firm say that this "was purchased for the best of meal and this is what we obtained."

Sample 8871 was sent by a correspondent and was drawn from goods sold by S. W. Hamilton. Sample 8903 and 8916 were taken by the inspector at the request of the dealers in order that they might put a proper guarantee upon them.

All of the recent shipments of Chicago Gluten Meal are up to guarantee, 38 per cent of protein and 2 per cent fat. The goods shipped into the State in the summer of 1899 were below this guarantee, and the State agents of the manufacturers have supplied correctly guaranteed tags for the old goods.

King Gluten Meal varies greatly in composition, that low in fat more nearly resembles Chicago Gluten. As the high percentage of fat called for by the guarantee is of doubtful advantage and its absence is always accompanied by higher protein content, the falling off in fat in these samples has not been reported.

The unguaranteed sample (9012) of oil meal is from high grade goods. The firm was reported to the Secretary of Agriculture for not branding.

The unguaranteed Daisy Corn and Oat Feed (8926) was reported to the Secretary of Agriculture. One old lot of American Poultry Food was not guaranteed. All late shipments are guaranteed.

## MIXED FEEDS.

In section 3 of the feeding stuffs law, it is stated that "mixed feeds" come under the requirements of the law. Under section 2, however, an exception is made of wheat rye and buckwheat bran or middlings not mixed with other substances. Soon after the law went into effect the Station analyzed a large number of the wheat offals which were being sold in the State and found them to be practically all good goods, although many of them were branded "mixed feed" and would therefore come under the law. After consultation with the Secretary of the Board of Agriculture it was decided for the present to omit all wheat offals from the requirements even though they might be denominated mixed feed.

In the fall of 1899 the Station began to receive from correspondents samples of goods that were bought for bran, but were of very low grade carrying from 9 to 12 per cent protein instead of the 15 to 17 per cent that good bran ought to carry. Investigation brought out the fact that certain mills in Kentucky and Tennessee and perhaps in other sections as well were adulterating bran by grinding and mixing with it such materials as corn cobs, the waste from corn broom factories, and the like.

In the present bulletin there are given twenty-four analyses of four brands of these mixed feeds which carry a much lower percentage of protein than brans should. The handlers of these particular brands are at the present time placing guarantees and tax tags upon them. In view of the fact that these adulterations make it necessary for the Station to examine all mixed feeds in order to see whether they are straight wheat offals or not, it has been decided that from this time on the strict letter of the law will be observed, and that the only concentrated feeds which will not be subject to the requirements are the meals made from pure grains and wheat, rye and buckwheat brans or middlings.

All mixed feeds, even though they are the straight refuse from the milling of wheat, will be hereafter included in the requirements and it will be necessary for these goods to carry the brand, as defined in section 1 and the inspection tax tags, as defined in section 5 of the feeding stuffs law, chapter 334, Public Acts of 1897.

## FEEDING CHICKENS FOR GROWTH.

G. M. GOWELL.

COOPS VS. YARDS.

This study was undertaken to compare the rapidity of growth of chickens confined in small coops vs. chickens kept in sheds and small yards.

Ten coops, each with a floor space sixteen by twenty-three inches, were constructed of laths with close end partitions of boards. The floors were of laths placed three-fourths of an inch apart and one inch from the walls, so that they might be kept clean by the moving about of the birds. The coops were made two together without cutting the laths. The laths ran lengthwise of the coops on bottom, top and back, but on the front they were placed upright, and two inches apart so that the chickens could feed through between them readily. V-shaped troughs with three-inch sides were placed in front of and about two inches above the level of the floors of the coops.

These coops are of about the same size and form as those used by the English and French chicken fatteners who make a specialty of the business, fattening many thousands each year. They were located in the light, airy, cemented basement of the barn where they were free from disturbance, and the variations of temperature were not great.

The chickens used in the test were raised under similar conditions and from the same hatch. They were one hundred and thirty days old at the commencement of the test and all were pure blooded Barred Plymouth Rocks, White Wyandottes, or the Eaton strain of Light Weight Light Brahmas.

Four chickens were placed in each coop and fed on thick raw porridge, made by mixing meal with cold skimmed-milk, making it thick enough so it would drop and not run from the end of a wooden spoon.

The meal mixture employed was made up by mixing 100 pounds corn meal, 80 pounds wheat middlings, 50 pounds fine ground oats, and 40 pounds of fine animal meal. They were fed all of the porridge they would eat, twice each day. The troughs were removed and cleaned in half an hour after the commencement of each meal. They were constantly supplied with water.

Feeding was commenced August 24th and continued until September 28th—thirty-five days. The birds were weighed at the end of each week, at the same hour so that they might be equally empty of food at each weighing.

They consumed 477 pounds of meal and 84 gallons of skimmed milk. The forty chickens weighed at the commencement of the test 147.9 pounds and at its close 237.1 pounds and had gained 89.2 pounds, an average of 2.23 pounds per chicken live weight. The quantity of the dry meal required to produce a pound of gain was 5.94 pounds.

On the day that the feeding of the cooped birds was commenced, twenty of their mates were put in a house nine by eleven feet in size, with an attached yard twenty feet square. The yard was entirely bare of anything that would serve as green food.

They were fed, during the thirty-five days, on the same grain mixture with milk, as those confined in the small coops. The twenty birds weighed at the commencement of the test 66.6 pounds and at the close 116.0 pounds, making a gain of 49.4 pounds; an average of 2.47 pounds to each. The quantity of the dry meal required to produce a pound of gain was 5.52 pounds. In these tests greater total and individual gains and cheaper flesh productions were secured from the birds with partial liberty than from those in close confinement. The labor was less in caring for the yarded birds. The cooped birds were very quiet and did not appear to suffer from confinement.

When dressed, all of the carcasses in both lots were even, well-formed and handsome. The results indicate that there is no advantage in close confinement, but that rather greater gains and cheaper production result from partial liberty. That our success with the small coops was as good as that of the foreigners is shown by the reports of the English and Canadian

fatteners. In another test made for the purpose of noting the effects of age, on the development and fleshing of chickens, as detailed beyond, it was incidentally shown that there is no advantage in very close confinement.

The tables which follow give the details of the experiments.

## CHICKENS CLOSELY CONFINED IN COOPS AND FED THIRTY-FOUR DAYS

AGE OF CHICKENS AT COMMENCEMENT OF TEST—130 DAYS.

Coop.	Chickens.	LIVE WEIGHTS DURING EXPERIMENT.								Dressed weight.
		Aug. 24.	Aug. 31.	Sept. 7.	Sept. 14.	Sept. 21.	Sept. 28.	Increase.		
								Lot.	Each.	
1	4 Plymouth Rocks ..	lbs. 12.2	lbs. 14.9	lbs. 17.3	lbs. 19.1	lbs. 21.7	lbs. 22.8	lbs. 10.6	lbs. 2.65	lbs. 16.5
2	4 Plymouth Rocks ..	14.2	16.1	18.0	20.4	22.7	23.9	9.7	2.42	17.8
3	4 Plymouth Rocks ..	16.0	18.0	20.1	22.2	24.3	25.4	9.4	2.35	19.5
4	4 Plymouth Rocks ..	15.4	17.9	19.8	22.0	24.2	24.9	9.5	2.37	19.7
5	4 Plymouth Rocks ..	14.5	16.8	18.8	20.3	22.8	23.7	9.2	2.30	18.4
6	4 Plymouth Rocks ..	13.4	15.0	17.1	18.6	20.7	22.0	8.6	2.15	16.4
7	4 Plymouth Rocks ..	16.2	18.2	20.1	21.8	23.8	24.2	8.0	2.00	19.8
8	4 White Wyandottes	14.8	16.7	18.8	19.9	21.6	22.3	7.5	1.87	16.8
9	4 Brahmas .....	16.4	19.2	21.3	22.6	24.4	25.5	9.1	2.27	19.0
10	4 White Wyandottes	14.8	17.2	19.0	20.3	21.7	22.4	7.6	1.90	16.8
	Total weights ...	147.9	170.0	190.3	207.1	227.9	237.1	.....	.....	180.7
	Increase in weight..	.....	22.1	20.3	16.8	20.8	9.2	89.2	2.23	.....

Pounds of grain mixture required to produce a pound of gain 5.94.

TWENTY CHICKENS (FOURTEEN PLYMOUTH ROCKS, FOUR WHITE WYANDOTTES, TWO BRAHMAS) CONFINED IN HOUSE AND SMALL YARD AND FED THIRTY-FIVE DAYS.

AGE OF CHICKENS AT COMMENCEMENT OF TEST—130 DAYS.

LIVE WEIGHT.				Total dressed weights.
August 24.	September 28.	Increase in weights.		
		Total.	Each.	
Lbs. 66.6	Lbs. 116.0	Lbs. 49.4	Lbs. 2.47	Lbs. 92.0

Pounds of grain mixture required to produce a pound of gain, 5.52.

*Financial Results.*

Taking the sixty cooped and uncooped birds together and considering the gains in flesh, and the cost of the food used, enables us to form opinions as to the advisability of selling chickens from the range when in growing condition, or specially preparing them for higher priced markets.

If these birds had been dressed without fattening at the commencement of the feeding test, and had shrunk the same per cent that they did when slaughtered, they would have yielded 165.5 pounds of dressed meat worth at 13 cents per pound, \$21.51. At the close of the test they dressed 272.7 pounds and were sold at 15 cents per pound net, yielding \$40.90. This shows that their value was increased by fattening \$19.39. The increase was probably more than this amount as we found in other tests that the percentage of shrinkage in dressing lean chickens was greater than in fat ones. Thirteen cents was as much as the unfattened birds would have sold for—slowly—while the fattened ones sold quickly in the same market at fifteen cents per pound. They were very much improved in quality by fattening. The flesh was white and soft and when roasted the thighs were soft, juicy and free from strings.

The amount of the dry food used was 750 pounds and cost \$7.91. The skimmed milk was 140 gallons, worth \$2.80, making the total food used worth \$10.71, which amount taken from the increased value of the chickens leaves a balance of \$8.68 gain on the sixty birds; an average increase of a little more than 14 cents on each one above the cost of food used.

A very large proportion of the chickens raised in this State are sent to market alive, without being fattened, usually bringing to the growers from twenty-five to thirty-five cents each. These tests indicate that they can be retained and fed a few weeks in inexpensive sheds or large coops with small runs and sent to the markets as dressed meat and make good returns for the labor and care expended.

The quality of the well-covered, soft-fleshed chickens, if they are not too fat, is so much superior to the same birds not specially prepared that they will be sought for at the higher price. The dairy farmer is especially well prepared to carry on this work as he has the skimmed milk which is of the greatest importance in securing yield and quality of flesh.

## EFFECTS OF AGE.

In order to compare the gains made with chickens of different ages, twenty of the same hatch that were used in the previous tests were taken for the later feeding. When the former tests were started the birds were one hundred and thirty days old. This test was commenced when they were one hundred and seventy days old. During the time that their mates had been shut up for fattening, they had the liberty of a large yard with an abundance of green food. They had been fed mash in the morning and mixed grain and cracked corn at noon and night. They had been growing bone and muscle but were not meaty. Twenty of them were put in the small coops—four in each one—and fed from the same meal and milk mixture that was used in the previous tests. When the experiment began, October 11th, they weighed 100.2 pounds. They were fed twenty-one days and then weighed 117.5 pounds having gained 17.5 pounds, an average to each bird of .87 pounds. They consumed 144 pounds of the dry meal and the same relative amount of milk as in the earlier test. 8.2 pounds of the mixed meal was required to make a pound of live chicken. With the confined young birds in the previous test but 5.94 pounds of food were required to yield a similar amount. The gain per bird of .87 pounds was markedly less than that of the younger birds of 1.48 pounds during the first twenty-one days of their test.

When these chickens were put in the small coops twenty-five of their mates of the same hatch were put in a house nine by eleven feet with a yard twenty feet square, and fed twice a day on the same mixture of meal and milk. None of the birds received green food. During the twenty-one days they gained 23.2 pounds, an average per bird of .92 pounds, while in the previous test with the young yarded chickens, the average gain during the first twenty-one days was 1.59 pounds.

This decreased gain in the case of the older chickens corresponds with the recognized law in animal feeding, that the younger the creature is the less the quantity of food required to produce a pound of growth. For the moderate difference (6 weeks) in the ages of the two lots of chickens this variation in the amounts of food required to produce a pound of gain

seems extravagant, but when it is considered how rapidly chickens mature it is not unreasonable. The practice of successful poultrymen in selling the cockerels at the earliest marketable age is well founded, for the spring chicken sold at Thanksgiving time is an expensive product.

The average live weights of the two lots at slaughtering was very nearly alike, viz. 5.88 pounds for the younger and 5.83 pounds for the older ones. The young ones were better in appearance, being thicker meated and softer, while the older ones showed a trifle more bone and a little harder flesh.

The details of the test are given in the tables which follow.

#### CHICKENS CLOSELY CONFINED IN COOPS AND FED TWENTY-ONE DAYS.

AGE OF CHICKENS AT COMMENCEMENT OF TEST—177 DAYS.

Coop	Chickens.	LIVE WEIGHTS DURING EXPERIMENT.						
		Oct. 11.	Oct. 18.	Oct. 25.	Nov. 1.	Increase.		Dressed.
						Lot.	Each.	
1	Four Plymouth Rocks .....	18.5	20.5	21.0	22.0	3.5	.87	17.4
2	Four Plymouth Rocks .....	20.2	21.4	22.6	24.4	4.2	1.05	19.3
3	Four Plymouth Rocks .....	20.8	22.4	22.8	23.5	2.7	.67	19.0
4	Four Plymouth Rocks ....	18.7	20.4	21.0	22.4	3.7	.94	18.6
5	Four Plymouth Rocks .....	22.0	23.3	25.2	25.4	3.4	.85	19.3
	Total weight .....	100.2	108.0	112.6	117.7	.....	.....	93.6
	Increase in weight .....	.....	7.8	4.6	5.1	17.5	.87	.....

Pounds of grain mixture required to produce a pound of gain, 8.2.

#### TWENTY-FIVE PLYMOUTH ROCK CHICKENS CONFINED IN HOUSE AND SMALL YARD AND FED TWENTY-ONE DAYS.

AGE OF CHICKENS AT COMMENCEMENT OF TEST—177 DAYS.

LIVE WEIGHT.				Total dressed weights.
October 11.	November 1.	Increase in weight.		
		Total.	Each.	
Lbs. 121.7	Lbs. 144.9	Lbs. 23.2	Lbs. .92	Lbs. 115.2

Pounds of grain mixture required to produce a pound of gain, 7.63.

*Financial Results.*

The forty-five birds weighed 221.9 pounds at the beginning of the test. If they had been dressed at that time and had shrunk at the same rate as they did when they were slaughtered they would have yielded about 177 pounds of dressed meat, worth at thirteen cents a pound \$23.01. They ate 321 pounds of mixed meal costing \$3.40, and 60 gallons skimmed milk worth \$1.20, altogether \$4.60, which taken from the increased value of the chickens leaves \$3.71 as the net gain,—not accounting for labor—or an average of 8.25 cents for each chicken.

Although the chickens employed in this test had been growing during the five weeks in which their mates in the first test had been undergoing fattening, they had not improved in condition sufficiently to sell at a better price per pound than at the commencement of the first test.

## THE EFFECT OF GREEN FOOD.

To study the effect of green food in fattening chickens, the following trial was made with twenty-four pure-blooded Plymouth Rock chickens that were one hundred and forty days old at the commencement of the test. They were confined in the small coops, described on page 89, four in each coop, and all fed for four weeks on the mixed meal and milk porridge twice each day.

The birds in coops 1 and 2 received no green food. Those in coops 3, 4, 5, and 6 received no green food during the first and second weeks, but during the third and fourth weeks they were given all the finely chopped green rape they would eat once a day. They did not consume as much of the rape per day as they had previously while living in the large yards, where they ate it voraciously. The quantity of porridge eaten by them was not noticeably greater or less when the rape was supplied. The gains made while the birds were supplied with green food were hardly as great as while confined to the porridge alone, but the difference was not very great.

The following table gives the details of the experiment.

**TWENTY-FOUR PLYMOUTH ROCK CHICKENS FED TWENTY-EIGHT DAYS  
WITH AND WITHOUT GREEN FOOD.**

**LIVE WEIGHTS DURING EXPERIMENT.**

Coop.	Feed.	Beginning.	End of first week.	End of second week.	End of third week.	End of fourth week.	INCREASE.	
							First and second weeks.	Third and fourth weeks.
1	No rape .....	lbs. 14.1	lbs. 16.	lbs. 18.2	lbs. 20.3	lbs. 22.6	lbs. 4.1	lbs. 4.4
2	No rape .....	15.7	17.8	19.5	21.8	23.6	3.8	4.1
3	No rape .....	15.4	17.6	19.4	-	-	4.0	-
3	Rape.....	-	-	-	2.01	22.6	-	3.2
4	No rape .....	14.6	16.9	18.9	-	-	4.3	-
4	Rape.....	-	-	-	20.4	22.7	-	3.8
5	No rape.....	13.8	15.4	17.5	-	-	3.7	-
5	Rape.....	-	-	-	18.9	21.0	-	3.5
6	No rape .....	15.8	17.8	19.7	-	-	3.9	-
6	Rape.....	-	-	-	21.5	23.4	-	3.7

Were it not for the check coops 1 and 2, the query might arise whether there might not be diminished gains from prolonged confinement during the 3d and 4th weeks. Coops 1 and 2 received no green food at any time, and their gains were a little better during the last than the first weeks. Although from experience we are persuaded of the value and even necessity of a free supply of green food for young growing chickens and breeding fowls, in this short period with rations composed so largely of milk, the growth was quite as satisfactory without an accompaniment of green food.

## BREEDING FOR EGG PRODUCTION.

G. M. GOWELL.

For several years the Station has been breeding with the hope of establishing families or strains of hens that shall excel as egg producers. It is known that the laws of inheritance and transmission are as true with birds as with cattle, sheep and horses, and when we consider the wonderful advance in egg production that the hen has made since domestication, there is ample reason for assuming that a higher average production than the present can be secured by breeding only to birds that are themselves large producers. It was found in practice that with the most careful selection we were including in our breeding pens birds that were not great producers, and that it was a prime necessity to ascertain the exact record of the eggs produced by each individual. This led to devising the trap nest described in the report of this Station for 1898.\*

This work, as undertaken, of breeding for more and better eggs will of necessity require much time, and several years will probably elapse before marked results may be looked for.

At this time cockerels are being raised from the hens that gave over two hundred eggs last year for our breeding next season. Among the two hundred additional hens undergoing test this year, it is hoped to find other large yielders and that next year we may have some pens where both the males and females will be from large producing dams. The three breeds taken for this work are kept separate and pure.

The first year's work in this selection of stock is here reported as a matter of record and not because definite results have yet been obtained.

Pure bred birds from three breeds were used, viz., Barred Plymouth Rocks, White Wyandottes, and the Eaton Strain of Light Brahmas. Two hundred and sixty April and May hatched pullets were put into breeding pens, November 1, 1898,

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\*A reprint of the paper describing the trap nest will be sent on application.

and records kept of their individual productions for a year. The purpose was to save those with yearly yields of one hundred and sixty eggs and over, and those with yields of one hundred or less, so as to see what variations there were in the individuals comprised in the flocks. As the room was needed for other birds on October 10th, 1899, some of the hens that had not sufficient time remaining in which to reach a yield of one hundred and sixty eggs in the year since commencing to lay, and that had produced one hundred eggs within the year were taken out of the test, consequently the average yield of all the hens for the full year cannot be given.

Of the two hundred and sixty hens put into the test, five died during the year and nineteen were stolen. Of the two hundred and thirty-six remaining, thirty-nine each laid one hundred and sixty or more eggs and thirty-five laid less than one hundred each. Twenty-four of the one hundred and twenty-six Plymouth Rocks laid one hundred and sixty or more eggs each, and twenty-two laid less than one hundred each. Nine of the fifty-six Wyandottes each laid more than one hundred and sixty eggs and seven laid less than one hundred each. Six of the fifty-four Light Brahmas each laid more than one hundred and sixty eggs and six laid less than one hundred each. All birds were put into the test November first at which time some of the earliest ones had been laying for about two weeks. The year commenced November first for all birds that laid during that month. Some of the later hatched ones did not commence to lay until January and February and they were given a full year after they commenced.

The monthly records of the hens that laid more than 160 or less than 100 eggs in the first 12 months after they began laying follow.

EGG RECORDS OF HENS HATCHED IN 1898 WHICH LAID MORE THAN  
160 OR LESS THAN 100 EGGS IN THE FIRST 12 MONTHS AFTER THEY  
BEGAN LAYING.

FROM 126 BARRED PLYMOUTH ROCKS.

Number of the hen.	1898.		1899.												Total.
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
286.....	....	.....	.....	14	23	15	18	24	25	23	26	23	1	.....	*206
101.....	.....	..	18	15	21	21	24	21	17	26	17	21	3	.....	204
36.....	.....	15	9	23	23	19	16	21	19	13	15	8	20	.....	201
51.....	.....	7	14	14	20	17	16	24	24	22	18	15	.....	.....	191
7.....	19	11	19	19	23	16	16	14	14	17	21	.....	.....	.....	189
120.....	.....	.....	17	20	17	13	15	18	24	20	22	18	4	.....	188
74.....	.....	5	18	18	21	14	18	16	15	15	7	18	17	.....	182
70.....	.....	8	24	19	21	17	13	16	17	19	19	6	2	.....	181
126.....	.....	.....	11	12	21	19	18	20	14	11	15	11	14	14	180
10.....	16	14	5	20	23	19	19	18	17	10	14	.....	.....	..	175
31 .. .	6	5	9	22	23	20	20	18	19	16	9	8	.....	.....	175
159.....	.....	...	4	25	9	13	13	14	14	12	15	18	20	18	175
300.....	.....	.....	.....	19	18	11	17	14	13	17	8	21	20	17	175
289.....	.....	.....	.....	8	22	20	17	19	12	20	12	21	14	7	172
76.....	.....	...	15	20	18	18	22	19	24	19	14	.....	.....	.....	169
45.....	.....	17	22	19	22	17	15	14	13	11	7	9	13	1	166
205.....	.....	.....	.....	.....	.....	.....	.....	22	19	19	15	.....	.....	.....	166
30.....	7	7	18	16	19	19	19	20	22	8	8	2	...	..	165
209.....	.....	.....	2	20	20	18	18	13	17	17	12	17	10	.....	164
40.....	3	6	5	20	17	12	14	20	20	24	18	3	.....	.....	162
6.....	18	12	7	15	18	16	15	8	14	6	12	20	...	.....	161
117.....	.....	.....	10	2	20	24	17	19	23	25	20	1	.....	.....	161
80.....	.....	...	16	22	15	7	17	17	15	9	10	12	15	5	160
154.....	.....	.....	5	12	20	21	22	22	18	21	18	1	.....	.....	160
89.....	.....	.....	13	13	16	8	15	16	14	3	.....	.....	.....	.....	98
184.....	.....	.....	.....	9	19	17	22	17	....	6	6	1	.....	.....	97
21.....	10	16	7	16	.....	10	9	12	12	4	.....	.....	.....	.....	96
42.....	2	10	.....	13	6	8	12	15	11	8	5	.....	.....	.....	90
157.....	.....	.....	.....	19	13	12	8	11	15	4	6	1	.....	.....	89
60.....	.....	1	4	6	15	12	9	6	12	15	8	.....	.....	...	88

\* No. 286 was a late hatched pullet and did not begin laying until Feb. 12. To give her a full year she received credit for 14 eggs laid in January, 1900.

## EGG RECORDS OF HENS—CONTINUED.

Number of the hen.	1898.		1899.												Total.
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
95.....		3	19	8	10	9	11	4	11	6	5	.....	.....	.....	86
72.....	2	13	11	8	2	8	15	7	3	11	.....	.....	.....	.....	80
58.....		1	18	16	15	3	11	6	5	4	.....	.....	.....	.....	79
183.....				2	26	7	15	12	18	1	.....	.....	.....	.....	76
258.....				2	21	7	2	9	10	4	20	1	.....	.....	76
264.....				5	16	9	12	14	15	2	.....	.....	.....	.....	73
233.....				14	19	6	13	10	9	.....	.....	.....	.....	.....	71
239.....				13	21	.....	14	5	5	8	.....	.....	.....	.....	66
207.....			2	20	7	11	9	1	7	4	3	.....	.....	.....	64
176.....				12	10	.....	11	14	6	.....	.....	.....	.....	.....	53
41.....		16	3	.....	.....	.....	.....	19	8	6	.....	.....	.....	.....	52
256.....				1	18	8	3	11	12	3	1	.....	.....	.....	47
254.....				3	7	4	14	9	8	.....	.....	.....	.....	.....	45
236.....				1	18	4	10	.....	5	.....	.....	.....	.....	.....	38
162.....			9	9	8	2	3	5	1	.....	.....	.....	.....	.....	37
234.....				9	17	.....	6	4	.....	.....	.....	.....	.....	.....	36

## FROM 56 WHITE WYANDOTTES.

14.....	21	20	24	21	19	17	10	18	14	16	15	13	.....	.....	208
4....	20	.....	19	16	22	13	19	22	15	21	19	15	.....	.....	201
47.....	..	12	19	18	19	16	19	17	19	15	14	16	16	.....	200
8.....	14	17	13	14	18	17	15	11	12	14	15	10	.....	.....	170
280.....				5	1	13	23	18	21	15	21	21	17	15	170
242.....				15	24	13	16	16	17	14	12	14	12	14	167
203.....			2	21	17	16	10	15	16	15	13	14	13	14	166
134.....			9	16	16	17	14	16	14	10	15	6	16	16	165
215.....			1	17	19	8	21	13	17	18	22	12	11	6	165
108.....			16	22	15	13	14	9	.....	.....	.....	.....	.....	.....	89
18.....	9	.....	3	18	10	12	5	15	8	.....	.....	.....	.....	.....	80
79.....			13	18	14	10	11	8	5	.....	.....	.....	.....	.....	79
158.....				21	5	13	.....	15	7	9	6	2	.....	.....	78
255.....				3	18	14	11	20	8	.....	.....	.....	.....	.....	74
267.....				12	21	6	14	18	2	.....	.....	.....	.....	.....	63
170.....			3	10	11	7	8	11	9	.....	.....	.....	.....	.....	59

## EGG RECORDS OF HENS—CONCLUDED.

FROM 56 LIGHT BRAHMAS.

Number of the hen.	1898.		1899.												Total.
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
52.....	.....	11	19	20	21	20	19	20	21	18	19	1	5	...	194
139.....	...	.....	11	20	19	14	21	19	21	21	22	20	.....	6	194
61.....	.....	4	12	18	21	16	14	21	19	15	16	16	18	.....	190
43.....	.....	5	18	21	21	14	19	22	18	19	21	3	.....	.....	181
292.....	.....	.....	.....	21	22	12	17	16	15	16	16	13	13	20	181
50 ....	.....	17	19	20	17	19	14	14	13	10	13	5	18	..	179
236 .....	.....	.....	.....	18	16	6	6	14	10	5	8	4	.....	.....	87
198.....	.....	.....	.....	10	14	17	1	14	15	8	2	5	.....	.....	86
243.....	.....	.....	.....	3	10	10	16	18	3	7	8	.....	.....	.....	75
227.....	.....	.....	.....	6	24	8	7	8	6	.....	.....	.....	.....	.....	59
55.....	.....	.....	.....	6	11	9	3	10	7	8	1	.....	.....	.....	55

A study of the monthly record sheets shows great differences in the capacities of hens, and marked variations in the regularity of their work; some commencing early and continuing laying heavily and regularly month after month while others varied much, laying well one month or poorly or not at all the next.

It is impossible to account for these vagaries as the birds in each breed were bred alike and selected for their uniformity. All pens were of the same size and shape and contained the same number of birds. Their feeding and treatment were alike throughout. Whenever changes were made in the feed in one pen, they were made in the others. That they were in good health is shown by the fact that but two were ailing, and were taken out early; two crop bound; and one injured by rough treatment by a cockerel. Many of the lightest layers gave evidence of much vitality and in many instances there were no marked indications in form or type by which we were able to account for the small amount of work performed by them. Numbers 234, 70 and 236 yielded respectively 36, 37 and 38 eggs in the year. They were of the egg type and gave no evidence of weakness or masculinity.

Number 101, 286, 36, 47 and 14, with their yields of 204, 206, 201, 200 and 208 eggs during the year, were typical birds with

every indication of capacity, but they were equaled in appearance, in the minds of good judges, by other birds that yielded a much less number of eggs.

The size and uniformity of the eggs yielded are of a good deal of importance. It was very noticeable in these investigations that the eggs from hens that laid the greatest numbers averaged smaller in size than those from hens that did not produce so many. That this is not always the case is shown by the eggs from numbers 101 and 286 which were of good size and dark brown, while those from number 36 were small and lacking in color. For this defect number 36 has been excluded from the breeding pens.

Number 14 is a good, large, strong White Wyandotte and because of the quantity and quality of her productions she is a phenomenal bird. When she went into the test November 1st, 1898, she had been laying for over two weeks. At the end of the year she had two hundred and eight good brown eggs to her credit, and she still kept on, laying 18 eggs in November, 22 in December, 21 in January, 18 in February, 15 in March and 18 in April (just closed) giving her 112 in the first six months of her second year, and 320 in eighteen months, a little more than an egg in a day and three-fourths for the entire year and a half after she commenced laying.

When the eggs from the hens that had been laying long and freely were placed in incubation, many of them were found low in fertility, or entirely sterile, notwithstanding the hens had mated freely with vigorous cockerels. The percentage of infertility was much greater than in eggs from hens that had been laying moderately. The question arises whether a large percentage of the chickens raised each year are not the produce of the tardy and moderate layers that are comparatively fresh, rather than of the more valuable and persistent layers that have been hard at work all winter? If this is so, breeding from eggs as they are ordinarily collected, without a knowledge of the hens that produce them, can but tend to furnish a large proportion of chickens from the poorest hens in the flocks. The cockerels as well as the pullets raised in this way furnish the breeding stock for the next year and in this manner the reproduction of the poorer rather than the better birds is fostered.

## COFFEE SUBSTITUTES.

CHAS. D. WOODS and L. H. MERRILL.

During the last few years there has been a marked increase in the number of mixtures offered under different names as substitutes for coffee. Some of the earlier mixtures contained low grade coffee to give them flavor, but a quite exhaustive examination a year or two ago by the Connecticut Experiment Station showed them to be free from adulterations of this kind and that for the most part they are made from the cereal grains as claimed. Because of the extravagant claims made for the nutritive value of the decoctions prepared from these materials the following analyses were undertaken. The comments here made are in no wise intended to condemn these beverages but to point out that the claims for great nutritive value are not founded on fact. Whether hot beverages are or are not hygienic, a chemical study cannot show, but from the chemical composition of the infusions it is a simple task to pass upon their merits as food.

The materials here reported upon were purchased in the open market. No attempt was made to obtain samples of all of this class of preparations but it is believed that those here reported upon are fairly representative.

### *Description of Samples.*

No. 6179. *Postum Cereal* made by Postum Cereal Company, limited, Battle Creek, Mich. This is probably the most extensively advertised of any of the coffee substitutes. The following is from statements on the package.

"A toothsome and healthful beverage. Coffee sick people seldom charge their ill feelings to the true cause. Analytical chemistry shows the poisonous alkaloids of coffee, as in tobacco, whisky and morphine. A perfectly healthy man or woman can stand these for a time, but 'constant dripping wears a stone' and

finally headache, torpid liver, sick stomach or heart, and that 'weak all over' feeling show that a poisoned nervous system is calling for help and relief. Every morning and perhaps at dinner and supper another brutal blow is given. Small wonder that a fixed organic disease of some of the members is finally set up. Relief cannot be obtained unless the cause is removed."

"An honest product of the healthful grains given by all-wise nature for man's proper sustenance. It nourishes, strengthens and vitalizes."

"This natural food drink has a fragrance of its own. It is not tea or coffee, but is made from the healthful grains. Those who care to conserve their health and bodily vigor will find that the unnatural taste for tea and coffee will leave them in a few days, and a natural taste for a healthful drink will take its place."

No. 6180. *Caramel Cereal* manufactured by Battle Creek Sanitarium Health Food Company, Battle Creek, Mich. "A mixture of cereals so prepared as to constitute a wholesome substitute for coffee."

No. 6181. *Golden Grain Coffee* prepared by John A. Tibbs, Buffalo, N. Y. "Recommended by the medical profession for its nutritious and healthful properties."

"Contains the phosphorus besides other nourishment of the grain in a concentrated form."

"Children may be allowed free use of this preparation at each meal, as it is always wholesome, and in some cases may be preferable to milk."

No. 6182. *Old Grist Mill Entire Wheat Coffee*, Potter & Wrightington, agents, Boston, Mass. "Healthful and nutritious. The best substitute for coffee."

"Old Grist Mill Entire Wheat Coffee is a perfect hygienic product containing the entire wheat kernel roasted and ground."

"It aids digestion, is easily assimilated by the weakest stomach, and assists nature in preserving the complexion clear and fresh. It is in every sense a pure health food."

No. 6183. *Wheat-Shred Drink* manufactured by The Cereal Machine Company, Worcester, Mass. "A perfect food in liquid form." "Wheat-Shred Drink, is nutritive in the highest degree."

No. 6288. *Grain-o* prepared by the Genesee Pure Food Company, LeRoy, N. Y. "Grain-o is a pure food drink." "Grain-o aids digestion." "Has that rich seal brown of Mocha or Java, but it is made from pure grains and the most delicate stomach receives it without distress. It's nourishing and strengthening."

No. 6289. *Dr. Johnson's Cereal Coffee*. Wholesale and retail at Johnson Educator Food Store, No. 82 Boylston street, Boston, Mass. "A palatable, nutritious and wholesome beverage."

No. 6290. *MO-KO* prepared by John F. Bauer & Company, Mt. Morris, N. Y.

"Mo-ko aids digestion, soothes and quiets worn and wasted nerves." "Mo-ko, as a complexion beautifier, cannot be equalled. It tones the blood, and by its daily use will impart to the skin the healthful glow of youth." "Give the children Mo-ko to drink. It will make them strong and healthy, and will not injure them."

ANALYSIS OF THE WATER-SOLUBLE CONSTITUENTS OF COFFEE SUBSTITUTES.

Laboratory number.	Coffee substitute.	* Refuse.	SOLUBLE IN WATER.			
			Total solids.	Protein.	Carbo-hydrates.	Ash.
6179	Postum Cereal .....	% 48.8	% 51.2	% 3.1	% 44.9	% 3.2
6180	Caramel Cereal .....	71.5	28.5	2.0	23.8	2.7
6181	Golden Grain.....	77.6	22.4	4.9	13.4	4.1
6182	Old Grist Mill Coffee .....	64.9	35.1	5.6	26.9	2.6
6183	Wheat-Shred Drink .....	61.0	39.0	2.5	34.5	2.0
6288	Grain-O .....	53.2	46.8	2.5	42.5	1.8
6289	Dr. Johnson's Cereal Coffee .....	63.7	36.3	3.3	31.3	1.7
6290	Mo-Ko .....	72.0	28.0	1.4	25.1	1.5

The portions insoluble in water including the water in the preparations as sold.

From the above table it will be observed that Postum Cereal is the most soluble and Golden Grain the least soluble of the samples analyzed. The directions for preparation are quite different but in each case the coffee substitute is measured by spoonfuls and the water by cups. Measuring the material by rounded spoonfuls and assuming a cup to hold 180 cubic centi-

meters (about 5 cups to a quart) gives the figures in the following table:

AMOUNT OF INFUSION YIELDED BY ONE POUND OF THE COFFEE SUBSTITUTE WHEN PREPARED AS DIRECTED.

Laboratory number.	Coffee Substitute.	Liters.	Quarts.	Cups (180 cc.)
6179	Postum Cereal .....	10.31	10.9	57
6180	Caramel Cereal.....	11.34	12.0	63
6181	Golden Grain .....	15.12	16.0	83
6182	Old Grist Mill Coffee .....	32.40	34.1	180
6183	Wheat-Shred Drink.....	5.89	6.2	33
6288	Grain-O .....	6.48	6.9	36
6289	Dr. Johnson's Cereal Coffee.....	4.54	4.8	25
6290	Mo-Ko .....	3.63	3.8	20

The directions for preparation have no relation to their different solubilities, so it does not follow that the least soluble material makes the thinnest drink. For example, Caramel Cereal is less soluble than Old Grist Mill Coffee but when prepared in accordance with directions, the infusion of the former contains more than twice as much solids as that of the latter.

Skimmed milk is generally considered a pretty thin beverage but as seen from the following table it contains from three to twenty times as much solids as these so-called nutritious drinks. Wheat-Shred Drink is perhaps a fair illustration of these goods. The label claims it to be "nutritive in the highest degree" and yet one would have to drink four and one-half gallons of the infusion to get the amount of protein furnished by one quart of skimmed milk. A teacup full (1-5 of a quart) of the decoction of Postum Cereal, which it is claimed "nourishes, strengthens and vitalizes" contains about 1-7 of an ounce of solids (dry matter) and about 1-100 of an ounce of protein (nitrogenous matter). While it would take nearly 1-4 of a cup of skimmed milk to furnish this weight of solids, the protein of a cup of Postum Cereal is contained in a dessert spoonful of skimmed milk.

As stated above, the present paper has nothing to do with the hygienic question of hot or cold drinks. Viewed from the nutritive standpoint alone the following table shows that these coffee substitutes, like coffee itself, depend more for their food value upon the cream and sugar used than upon their own soluble constituents.

NUTRIENTS FOUND IN SKIMMED-MILK COMPARED WITH THOSE FOUND IN COFFEE SUBSTITUTE INFUSIONS PREPARED ACCORDING TO PRINTED DIRECTIONS.

Laboratory Number.		Total Solids.	Protein.	Fat.	Carbohydrates.	Ash.
		%	%	%	%	%
	Skimmed milk.....	9.75	3.50	.30	5.15	.80
6179	Postum Cereal.....	2.25	.14		1.97	.14
6180	Caramel Cereal.....	1.14	.08		.95	.11
6181	Golden Grain.....	.67	.15		.40	.12
6182	Old Grist Mill Coffee.....	.50	.08		.38	.04
6183	Wheat-Shred Drink.....	3.00	.19		2.66	.15
6288	Grain-o.....	3.28	.17		2.98	.13
6289	Dr. Johnson's Cereal Coffee.....	2.63	.33		3.13	.17
6290	Mo-Ko.....	3.50	.18		3.14	.19

## NUT OILS.

L. H. MERRILL.

In the summer of 1899 seventeen kinds of nuts were analyzed at this Station. The results of these analyses, together with a discussion of nuts as foods, were published in Bulletin 54. In those cases where the material at hand allowed, a sufficient amount of oil was obtained to permit a determination of the fuel value and a few other constants. Since several nut oils have already found an extended use, a contribution to the knowledge of those less known may prove of interest.

The nut kernels were finely ground and the dried material extracted with anhydrous ethyl ether. The solvent was removed by heating the solution upon the steam bath for one hour, or until the smell of ether had entirely disappeared, when the hot oil was filtered into bottles.

Several objections to this method of extraction suggest themselves, chief among which may be mentioned: (a) A possible failure to entirely remove the ether; (b) The oxidation of the oils in the final heating; (c) The presence of ether-soluble foreign matters which were present in the nuts and passed through into the oils.

Some of these dangers might have been avoided by using pressure instead of a solvent. But the use of pressure introduces another difficulty. Each of these oils consists of a mixture of from three to six or even more ethereal salts of widely varying fluidity. For this reason extraction by pressure must inevitably result in a partial separation of the oils, the less fluid remaining behind. The pressure method was employed in but one case, that of the cocoanut. It is interesting to note that in this particular instance the resulting oil (6227) differed but slightly from that obtained by ether from the same nut (6228). If a solvent be used, ether seems as little objectionable as any, since it is more readily removed from the extract than petroleum ether, and the second danger mentioned, that of oxidation, is materially reduced. As regards the third objection, the extraction of matters not oils, it should be said that so far as known

there is no practicable method of extraction which would yield a mixture of pure fats. Petroleum ether undoubtedly yields an extract freer from impurities than ethyl ether, but its higher boiling point would render it more difficult to remove.

Some of these nut oils are very complex compounds. Coconut oil contains large proportions of trimyristin and trilaurin, smaller quantities of tripalmitin and triolein, and also the glycerides of the volatile caproic, caprylic and capric acids.\* The walnut contains myristic and lauric acids, together with oleic, linolic, linolenic and isolinolenic acids.† Among the bodies not fats which frequently occurs are the lecithins, cholesterin and chlorophyl.

Of the oils here reported, those from the cocoanut and pistachio present the most marked peculiarities. Above 24° C. the former is perfectly colorless and clear as water. At the ordinary room temperature it hardens to an opaque white solid. The pistachio oil is a dark yellowish green, perhaps through the presence of chlorophyl. All the other oils are fluids at ordinary temperatures and to the casual observer present few points of difference, except as regards color, which varies from light straw to deep amber. For the most part they are without pronounced odor, though several readily suggest the nuts from which they were derived.

The instrument used in determining the refractive index was that of the Société Genevoise, furnished for the purpose by Prof. Stevens of the department of physics of the University. The instrument permits very accurate measurements. Although from four to six readings were taken for each oil, the variations were for the most part confined to the fifth decimal, here omitted. The temperature selected was that of the room at the time the work was begun. The specific gravity was determined by a carefully calibrated pyknometer, the standard chosen being distilled water at the same temperature, 24° C. The combustions were made in a bomb calorimeter of the Atwater model, made by O. S. Blakeslee of Middletown, Conn. Even with the usual pressure of oxygen, twenty atmospheres, it was found impossible to ignite the oil directly. After several unsuccessful

\* Lewkowitsch, *Oils, Fats and Waxes*, p. 538.

† Ibid, p. 350.

attempts of this kind, weighed filter blocks were used to absorb the oil. By previous experiments the fuel value of these blocks was found to be 4.130 calories per gram. For the iodine absorption number, Hubl's method,\* as adopted by the Association of Official Agricultural Chemists, was employed. The great capacity of some of the oils for iodine made necessary the addition of large quantities of the iodine solution, as in the case of the walnut oil, where 70cc were used. This fact is important since the method is an arbitrary one, the amount of the absorption being to some extent affected by the excess of iodine present. The results are not, therefore, so strictly comparable as in the case of butters, where the absorption varies so little that a constant amount of iodine can be used.

So far as the writer is aware no study has been made of the changes which these oils undergo through rancidity. They are so susceptible to such changes that the age of the nut must to a considerable extent affect the physical and chemical properties of the oils. The work here reported was done during the summer months and the nuts must therefore have been nearly a year old.

As regards the changes which oils may undergo by heating, attention may be called to the oils from the raw and roasted peanuts (6225 and 6226). Although the roasting was carried farther than usual, resulting in a decided darkening of the oil, the constants so far as determined were practically the same. It is probable that the drying oils, containing considerable amounts of linolic, linolenic and isolinolenic acids, would have undergone appreciable oxidation under the same conditions.

The refractive index, the specific gravity, the iodine absorption number, and the calories per gram of the different nut oils here reported are given in the table on the following page.

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\* Wiley's Agricultural Analyses, vol. III, page 364.

## CONSTANTS OF NUT OILS.

Laboratory number.	Kind of Nuts.	Refractive index, 20°C.	Specific gravity, 24°C.	Iodine absorption number.	Calories per gram.
6216	Beechnuts, <i>Fagus Americana</i> .....	1.4715	.9124	97.31	9.511
6217	Brazil nut, <i>Bertholletia excelsa</i> .....	1.4699	.9156	90.59	9.426
6218	Butternut, <i>Juglans cinerea</i> .....	1.4786	.9255	129.09	9.417
6219	Filbert, <i>Corylus</i> .....	1.4686	.9158	82.74	9.510
6220	Hickory, <i>Hicoria ovata</i> .....	1.4696	.9164	102.79	9.450
6221	Pecan, <i>Hicoria pecan</i> .....	1.4708	.9158	99.47	9.497
6222	Pistachio, <i>Pistachia vera</i> .....	1.4687	.9134	83.82	9.412
6223	Pine nut, <i>Pinus edulis</i> .....	1.4659	.9174	105.80	9.448
6224	Walnut, <i>Juglans regia</i> .....	1.4770	.9224	138.84	9.438
6225	Peanut, raw, <i>Arachis hypogæa</i> .....	1.4701	.9136	92.51	9.750
6226	Peanut roasted .....	1.4697	.9142	92.37	9.577
6227	Cocoanut, <i>a</i> , <i>Cocos nucifera</i> .....	1.4550	.9228	6.17	9.027
6228	Cocoanut, <i>b</i> .....	1.4553	.9223	6.27	9.066
	Brazil nut, <i>c</i> .....	.....	.9182	106.20	
	Cocoanut, <i>d</i> .....	1.4410	.8736-.925	8.0-9.5	
	Peanut, <i>e</i> .....	1.4540	.911-.922	85.6-1905.	
	Walnut, <i>f</i> .....	1.480	.925-.928	143.-151.7	

*a* Extracted by ether.

*b* Extracted by pressure alone.

*c* Lewkowitsch. Oils, Fats and Waxes, p. 396.

*d* Ibid., p. 539.

*e* Ibid., p. 443.

*f* Ibid., p. 351.

## TESTING GRASS SEED.

CHAS. D. WOODS.

The Legislature of 1897 enacted a law entitled "An Act to regulate the sale of agricultural seeds." This act makes it the duty of the Director of the Station to prescribe the methods to be used in examining seeds, and to "publish equitable standards of purity together with such other information concerning agricultural seeds as may be of public benefit."

The standards and methods of analysis were published as Bulletin 36 of this Station, copies of which can still be had on application.

Since the enactment of the seed law in Maine quite a number of samples (chiefly grass seeds) have been received by the Station for examination. Five grams of all the seeds submitted (excepting redtop of which only two grams were inspected) were examined. The inert matter and foreign seeds were separated by hand and then the foreign seeds classified into harmful and noxious. The inert matter and foreign seeds were weighed and the per cent calculated. The weed seeds were usually counted so as to give the number in a pound and the names of the weeds determined by comparison with sets of named seeds.

The samples of seeds received in 1898 were reported on pages 60-62 of the Report of the Station for that year. The samples examined in 1899 are here reported.

The inert matter consisted of sand, fragments of stems and leaves, chaff, whole insects, fragments of insects and insect excreta. The harmless foreign seed consisted mostly of redtop and clover in timothy, timothy, red top and clover in alsike and timothy and clover in redtop. Most of the samples examined came from outside the State and were purchased to sell as seed.

The kinds and amount of weed seeds found in the samples examined leads to the belief that seed for planting is not the only source of weeds in the State. A good many of the weed seeds found in the samples would not grow. An examination of whole grain brought in by the car-load and distributed in the State shows that it frequently carries many weed seeds. Inter-

state and State commerce where packing material is used are also important sources of weeds.

It will be noticed from the appended tables that the per cent of purity of seeds was for the most part high and that a large number of samples contained no weed seeds or only those that were not pernicious.

It is impossible to get a correct idea of the average per cent of purity of seed sold in the State from samples sent for examination, as one sample may represent only a few bags and another a car-load. A statement of the per cent of purity of a seed gives but little idea of its nature, as the impurities may be large and consist of harmless seeds or indifferent weeds, while one showing a low per cent of impurities may contain the vilest weed seeds.

The tables showing the results of the analyses of samples of seeds follow.

TABLE SHOWING THE RESULTS OF SEED ANALYSES INCLUDING PERCENTAGES OF PURITY, TOTAL IMPURITIES, INERT MATTER, FOREIGN AND WEED SEEDS.

Common Name.	Number of samples examined.				Samples free from inert matter.	Samples free from foreign seeds.	Samples free from weed seeds.	Highest per cent of purity.	Lowest per cent of purity.	Average per cent of purity.	Highest per cent of impurity.	Lowest per cent of impurity.	Average per cent of impurity.	Per cent of weed seeds.	Per cent of inert matter.
Red Clover .....	24	1	2	2	100.0	96.3	99.67	3.7	.....	.33	.48	.24			
Alsike .....	17	2	....	4	99.9	96.2	98.87	4.0	.1	1.13	1.34	.36			
Timothy .....	38	3	8	10	100.0	97.9	99.26	2.1	.....	.74	.29	.53			
Redtop .....	14	....	6	6	99.8	90.66	96.51	9.33	.3	3.49	.92	2.58			
Orchard Grass .....	2	....	...	....	97.90	97.72	97.81	2.28	2.10	2.19	.46	1.73			
Kentucky Bluegrass	1	....	...	....	98.2	98.2	98.2	1.8	1.8	1.8	.35	1.45			
Hungarian Grass....	4	....	1	1	99.84	98.5	99.31	1.5	.16	.69	.42	.27			
Wheat .....	1	1	1	1	100.0	100.0	100.0	.....	.....	.....	.....	.....			
Lawn Grass Mixture	2	....	....	....	97.20	83.70	90.45	16.3	2.8	9.55	.4	1.41			



## POTATO POMACE.

J. M. BARTLETT.

Potato pomace is the residue which is left in the manufacture of starch from potatoes. This material contains nearly all the fiber, protein, fat and a large part of the starch found in the fresh potato.

As it comes from the factory it is necessarily incorporated with a large amount of water through the method of manufacture. The process in general use in this country and Europe is briefly stated as follows:

The tubers after being thoroughly cleansed of all dirt are placed in iron grinding cylinders with saw teeth which lacerate the cells, setting the starch granules free. The ground mass is then washed with cold water on sieves placed over tanks, the starch granules passing through and settling out in the bottom of the tank while the pulp passes off with another portion of the wash water. As this pulp residue all goes to waste in this country the process is necessarily a wasteful one, and manufacturers have been giving some thought to devising a method of recovering it. The chief obstacle to its use in the fresh condition is the large amount of water it contains. If some method could be devised for cheaply removing the larger part of the water, the dry matter would have considerable value as a feeding stuff. Of course, the material could be fed with 80 to 90 per cent of water present, but in this condition it would keep but a short time, and as the period for manufacturing starch extends over but a few weeks of the year it would be available for only a very limited time for food; dried, however, it would keep any length of time.

In Europe the potato and beet residues from the manufacture of alcohol are quite extensively used as feeds in the wet condition, 80 to 125 pounds being fed to cattle daily per head. This material probably does not vary greatly in composition from the starch factory residue, but the manufacturing is conducted on

a small scale, usually by the farmers themselves, and extends over quite a long period so this pomace can be conveniently fed out in the wet state.

Two samples of potato pomace have been sent to the Experiment Station for analysis to determine their value. One was from a New Sweden factory and the other from Houlton. The results of the analysis are given in the following tables:

TOTAL FEED NUTRIENTS IN POTATO POMACE.

	FRESH MATERIAL.						WATER-FREE.				
	Water.	Ash.	Protein.	Fiber.	N free extract.	Fat.	Ash.	Protein.	Fiber.	N free extract.	Fat.
New Sweden Sample .....	88.36	.36	.970	1.35	8.990	.070	3.02	7.36	11.52	77.52	.58
Houlton Sample .....	95.11	.16	.40	.55	3.75	.04	3.19	8.16	11.26	76.60	.79

TOTAL FERTILIZING ELEMENTS IN POTATO POMACE.

FRESH MATERIAL.				WATER-FREE.		
Water.	Nitrogen.	Phosphoric acid.	Potash.	Nitrogen.	Phosphoric acid.	Potash.
88.36	.117	.029	.115	1.18	.25	.97
95.11	.064	.013	.071	1.31	.26	1.46

## FERTILIZER INSPECTION.

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CHAS. D. WOODS, Director.

J. M. BARTLETT, Chemist in charge of Fertilizer Analysis.

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The law regulating the sale of commercial fertilizers in this State calls for two bulletins each year. The first of these contains the analyses of the samples received from the manufacturer, guaranteed to represent, within reasonable limits, the goods to be placed upon the market later. The second bulletin contains the analyses of the samples collected in the open market by a representative of the Station.

The analyses of the manufacturer's samples for this year were published early in March. The present bulletin contains the analyses of the Station samples and of such of the manufacturer's samples as were received after Bulletin 50 was issued.

### *The Guaranteed Analysis.*

The law requires that there shall be affixed to each package of fertilizer offered for sale in the State, "a plainly printed statement clearly and truly certifying the number of net pounds in the package sold or offered for sale, the name or trade mark under which the article is sold, the name of the manufacturer or shipper, the place of manufacture, the place of business and a chemical analysis stating the percentage of nitrogen, or its equivalent in ammonia in available form, of potash soluble in water, and of phosphoric acid in available form, soluble and reverted, as well as the total phosphoric acid, and the law directs that there shall be filed annually with the Director of the Maine Agricultural Experiment Station a *certified* copy of the above statement. Very soon after Bulletin 60, containing the analyses of the manufacturers' samples, was distributed a correspondent called our attention to the fact that, in the case of one prominent brand, there was considerable discrepancy between the guarantee published by the Station and that printed on the package. The correspondent also sent us printed matter in which a still different

claim was made by the manufacturer as to the composition of the goods in question. To see if this was at all common, the inspector was instructed to take an exact copy of all guaranteed analyses found on the packages sampled. As a result it was found that 70 different brands carried, in the case of at least one of the ingredients, a different statement on the bag from the certified statement filed with the Station. Some of these cases may be explained by the goods being last year's goods. We analyzed no fertilizers that the manufacturers' agents *said* were last year's goods. In about one-third of the cases the figures on the packages are lower (but only slightly lower) than the certified guarantees. In a few instances the manufacturers make no claim on the package for phosphoric acid called for by their certificate. The tankage of the Portland Rendering Company carried no guaranteed analysis on the package. In the other cases the guarantee on the package is larger and frequently much larger than the certified copy.

The tables on pages 128-131 gives the minimum certified guaranteed analysis; the minimum guarantee on the package and the percentages found in the sample collected by the Station. The figures under the head of "found" are those showing the actual composition of the samples.

### *The Results of the Analyses.*

The tables on pages 120 to 127 contain the results of the analyses of the samples collected by the inspector from goods in the open market. The figures which were given as the percentages of valuable ingredients guaranteed by the manufacturers are the minimum percentages of the certified guarantee. If, for instance, the guarantee is 2 to 3 per cent. of nitrogen, it is evident that the dealer cannot be held to have agreed to furnish more than 2 per cent., and so this percentage is taken as actual guarantee. The figures under the head of "found" are those showing the actual composition of the samples. Whenever the sample examined contains less than the guaranteed percentage of any ingredient the deficiency is indicated in the table by a †.

A comparison of the results of the analyses of the samples collected by the Station with the percentages guaranteed by the manufacturers shows, that many of the manufacturers do not

intend to do much more than make good the minimum guarantee, and it is not surprising that this results in some of the goods falling below the guarantee in one or more ingredients. The table which follows gives the names of the goods and the ingredients in which they are deficient. No brand is included in this list unless it falls short at least one-tenth in one or more of its ingredients.

A LIST OF FERTILIZERS SOLD IN MAINE IN 1900 THE OFFICIALLY COLLECTED SAMPLES OF WHICH CONTAINED LESS THAN NINE TENTHS OF THE GUARANTEED AMOUNTS OF ONE OR MORE OF THE FERTILIZING CONSTITUENTS.

Station number.	Kind of Fertilizer	Deficient in
2408	Blanchard's Fish, Bone and Potash .....	Total phosphoric acid.
2409	Blanchard's Grass and Grain Fertilizer .....	Nitrogen and potash.
2410	Blanchard's Ground Fish Scrap .....	Potash.
2427	Stockbridge Potato and Vegetable Manure .....	Nitrogen.
2428	Stockbridge Seeding Down Manure .....	Nitrogen.
2477	Swift's Lowell Ground Bone .....	Nitrogen.
2506	Philbrick's Fertilizer.....	Nitrogen.
2508	Provincial Chemical Fertilizer Co.'s Potato Phosphate .....	Potash.
2518	Read's Sure Catch Fertilizer .....	Available and total phosphoric acid.
2520	Read's Sampson Fertilizer .....	Available phosphoric acid
2531	Sagadahoc Special Potato Fertilizer (sampled at Bangor) .....	Nitrogen.
2533	Yankee Fertilizer .....	Total phosphoric acid and nitrogen.
2551	Crocker's Potato, Hop and Tobacco Phosphate.....	Nitrogen.
2556	Sagadahoc Special Potato Fertilizer (sampled at Bowdoinham) .....	Nitrogen.
2557	Sagadahoc Superphosphate. ....	Nitrogen.

While the number of brands which are considerably below their guarantee in one or more ingredients is quite large, (15), it is less than last year and there is little reason for thinking that there is intention to defraud. It frequently happens that a fertilizer which is below in one ingredient is considerably above in others. While this frees the manufacturer from suspicion of attempting to defraud, it is, nevertheless, a serious defect in the fertilizer. It is not enough that a fertilizer contains an equivalent amount of some other kind of plant food. When the purchaser pays for fifty pounds of nitrogen he is not rightly treated if the manufacturer gives him thirty pounds of nitrogen, even though he gives him enough more of potash or phosphoric acid to make a financial equivalent.

## DESCRIPTIVE LIST OF STATION SAMPLES, 1900.

Station number.	Manufacturer, place of business and brand.	Sampled at
	HIRAM BLANCHARD, EASTPORT, ME.	
2408	Blanchard's Fish, Bone and Potash .....	Houlton .....
2409	Blanchard's Grass and Grain Fertilizer .....	Eastport .....
2410	Blanchard's Ground Fish Scrap .....	Eastport .....
	THE BOWKER FERTILIZER CO., BOSTON, MASS.	
2411	Bowker's Corn Phosphate .....	Bangor .....
2412	Bowker's Early Potato Manure .....	Houlton .....
2413	Bowker's Farm and Garden Phosphate .....	Portland .....
2414	Bowker's Fresh Ground Bone .....	Portland .....
2415	Bowker's Hill and Drill Phosphate .....	Bangor .....
2416	Bowker's Potash Bone .....	Belfast .....
2417	Bowker's Potato and Vegetable Fertilizer .....	Bangor .....
2418	Bowker's Potato and Vegetable Phosphate .....	Belfast .....
2419	Bowker's Six Per Cent Potato Fertilizer .....	Houlton .....
2420	Bowker's Square Brand Bone and Potash .....	Portland .....
2421	Bowker's Staple Phosphate or Three Per Cent Fertilizer .....	Bangor .....
2422	Bowker's Sure Crop Phosphate .....	Portland .....
2423	Bowker's Ten Per Cent Manure .....	Houlton .....
2424	Gloucester Fish and Potash .....	Bangor .....
2425	Stockbridge Corn and Grain Manure .....	Portland .....
2426	Stockbridge Pea and Bean Manure .....	Bangor .....
2427	Stockbridge Potato and Vegetable Manure .....	Portland .....
2542	Stockbridge Potato and Vegetable Manure .....	Bangor .....
2428	Stockbridge Seeding Down Manure .....	Bangor .....
	BRADLEY FERTILIZER CO., BOSTON, MASS.	
2429	Bradley's Complete Manure for Potatoes and Vegetables .....	Houlton .....
2546	Bradley's Complete Manure for Potatoes and Vegetables .....	Caribou .....
2430	Bradley's Corn Phosphate .....	Portland .....
2547	Bradley's Corn Phosphate .....	Bangor .....
2431	Bradley's Eureka Fertilizer .....	Bangor .....
2432	Bradley's Niagara Phosphate .....	Bangor .....
2433	Bradley's Potato Fertilizer .....	Belfast .....
2548	Bradley's Potato Fertilizer .....	Portland .....
2434	Bradley's Potato Manure .....	Houlton .....
2435	Bradley's X. L. Superphosphate .....	Bangor .....
	CLARK'S COVE FERTILIZER CO., BOSTON, MASS.	
2436	Bay State Fertilizer .....	Portland .....
2437	Bay State Fertilizer, G. G. .....	Bangor .....
2438	Bay State Fertilizer for Seeding Down .....	Bangor .....
2439	Defiance Phosphate .....	Bangor .....
2440	King Philip Alkaline Guano .....	Portland .....
	CLEVELAND DRYER CO., BOSTON, MASS.	
2441	Cleveland Fertilizer for All Crops .....	Bangor .....
2442	Cleveland Potato Phosphate .....	Portland .....
2443	Cleveland Seeding Down Fertilizer .....	Bangor .....
2444	Cleveland Superphosphate .....	Portland .....
	E. FRANK COE CO., NEW YORK, N. Y.	
2445	E. Frank Coe's Celebrated Special Grass and Grain Fertilizer .....	Bangor .....
2446	E. Frank Coe's Columbian Corn Fertilizer .....	Portland .....
2447	E. Frank Coe's Columbian Potato Fertilizer .....	Bangor .....

## FERTILIZER INSPECTION.

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## ANALYSES OF STATION SAMPLES, 1900.

Station number.	NITROGEN.				PHOSPHORIC ACID.								POTASH.	
	Soluble in water.	Insoluble in water.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.	
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.			
	%	%	%	%	%	%	%	%	%	%	%	%	%	
2408	1.32	2.08	3.40	3.00	.....	3.22	.31	3.22	3.00	3.53	4.00	3.15	3.00	
2409	1.10	2.70	3.80	4.47	.....	3.41	.65	3.41	3.00	4.06	4.28	†1.30	2.00	
2410	1.14	2.54	†3.68	4.00	.....	3.65	.53	3.65	3.00	4.18	4.00	†.89	1.00	
2411	.43	1.20	1.63	1.60	4.19	4.13	1.90	8.32	7.00	10.22	9.00	2.49	2.00	
2412	2.41	.78	3.19	3.00	5.70	2.10	2.17	7.80	7.00	9.97	9.00	7.58	7.00	
2413	.54	1.12	1.66	1.50	6.15	3.59	2.45	9.74	8.00	12.19	10.00	2.26	2.00	
2414	.42	2.26	2.68	2.25	.....	.....	.....	.....	.....	24.10	24.00	.....	.....	
2415	1.18	1.08	2.26	2.25	4.94	3.96	2.58	†8.90	9.00	11.48	12.00	2.30	2.00	
2416	.15	.66	.81	.75	1.14	6.58	2.71	7.72	6.00	10.43	8.00	2.57	2.00	
2417	.85	1.66	2.51	2.25	6.70	2.92	2.90	9.62	8.00	12.52	10.00	4.58	4.00	
2418	.52	1.14	1.66	1.50	7.24	3.24	2.12	10.48	8.00	12.60	10.00	2.34	2.00	
2419	.24	.68	.92	.75	5.14	3.92	1.80	9.06	7.00	10.86	10.00	6.18	6.00	
2420	.51	1.34	1.85	1.50	1.85	4.80	5.60	6.65	6.00	12.25	12.00	2.51	2.00	
2421	.22	.62	.84	.75	3.60	5.22	1.66	8.82	8.00	10.48	10.00	3.28	3.00	
2422	.24	.72	.96	.75	5.83	3.86	2.39	9.69	9.00	12.08	11.00	2.05	2.00	
2423	.20	.62	.82	.75	2.57	4.41	3.40	6.98	6.00	10.38	8.00	10.44	10.00	
2424	.16	.68	.84	.75	5.26	5.03	2.04	10.29	6.00	12.33	9.00	1.35	1.00	
2425	1.56	1.52	3.02	3.00	7.46	2.43	1.22	9.89	8.00	11.11	10.00	7.07	6.00	
2426	.20	2.00	2.20	2.00	3.29	3.87	4.12	7.16	6.00	11.28	8.00	11.59	6.00	
2427	1.20	1.64	†2.84	3.25	4.72	2.44	1.49	7.16	6.00	8.65	7.00	†9.92	10.00	
2545	1.36	2.00	3.36	3.25	5.41	2.45	1.27	7.86	6.00	9.13	7.00	10.23	10.00	
2428	.73	1.32	†2.05	2.50	3.47	4.54	2.69	8.01	6.00	10.70	10.00	10.22	10.00	
2429	1.71	1.28	†2.99	3.30	5.41	3.44	1.50	8.85	8.00	10.35	9.00	7.10	7.00	
2546	1.54	1.58	†3.12	3.30	5.29	3.26	1.80	8.55	8.00	10.35	9.00	7.71	7.00	
2430	.94	1.15	2.08	2.06	5.70	3.45	2.31	9.15	8.00	11.46	10.00	1.89	1.50	
2547	.52	1.78	2.30	2.06	6.13	3.54	2.34	9.67	8.00	12.01	10.00	2.02	1.50	
2431	.22	.98	1.20	1.03	5.63	2.55	1.77	8.18	8.00	9.95	9.00	2.25	2.00	
2432	.01	1.14	1.15	.82	3.22	5.09	1.69	8.31	7.00	10.00	8.00	1.35	1.08	
2433	.72	1.36	2.08	2.06	6.44	2.71	1.54	9.15	8.00	10.69	10.00	3.17	3.00	
2548	.97	1.15	2.12	2.06	5.94	2.71	1.97	8.65	8.00	10.62	10.00	3.18	3.00	
2434	.91	1.60	2.51	2.50	4.36	2.12	2.16	6.48	6.00	8.64	8.00	5.58	5.00	
2435	.95	1.56	2.51	2.50	6.73	2.99	2.10	9.72	9.00	11.82	11.00	2.32	2.00	
2436	1.44	1.06	2.50	2.47	6.09	3.01	1.99	9.10	9.00	11.09	10.00	2.30	2.00	
2437	.61	1.56	2.17	2.06	5.36	4.29	2.43	9.65	8.00	12.08	9.00	2.08	1.50	
2438	.27	.86	1.13	1.03	5.55	3.55	1.75	9.10	8.00	10.85	10.00	2.47	2.00	
2439	.43	.86	1.29	.82	4.22	4.86	2.37	9.08	7.00	11.45	9.00	1.80	1.00	
2440	.32	.88	1.20	1.03	4.78	3.71	2.89	8.49	8.00	13.38	9.00	2.16	2.00	
2441	.41	.74	1.15	1.03	5.53	3.84	1.28	9.37	8.00	10.65	9.00	2.29	2.00	
2442	1.06	1.18	2.24	2.05	5.66	2.86	2.00	8.52	8.00	10.52	10.00	3.29	3.00	
2443	.35	.88	1.23	1.03	4.88	3.77	1.66	8.65	8.00	10.31	9.00	2.39	2.00	
2444	.97	1.10	2.07	2.03	6.20	2.48	2.30	8.68	8.00	10.98	9.00	1.87	1.50	
2445	.44	.64	1.08	.80	7.06	2.90	2.44	9.96	8.50	12.40	10.00	2.08	1.25	
2446	.71	.48	†1.19	1.20	5.40	3.66	3.29	9.06	8.50	12.35	9.50	2.55	2.50	
2447	.72	.70	1.42	1.20	5.80	3.44	2.51	9.24	8.50	11.75	10.00	*2.81	2.50	

\*Potash largely sulphate.

†Below guarantee.

## DESCRIPTIVE LIST OF STATION SAMPLES, 1900.

Station number.	Manufacturer, place of business and brand.	Sampled at
2448	E. Frank Coe's Excelsior Potato Fertilizer .....	Portland .....
2549	E. Frank Coe's Excelsior Potato Fertilizer .....	Bangor .....
2449	E. Frank Coe's High Grade Ammoniated Bone Superphosphate .....	Portland .....
2450	E. Frank Coe's High Grade Potato Fertilizer .....	Bangor .....
2451	E. Frank Coe's New Englander Corn Fertilizer .....	Portland .....
2452	E. Frank Coe's New Englander Potato Fertilizer .....	Bangor .....
2453	E. Frank Coe's Prize Brand Grain and Grass Fertilizer .....	Portland .....
2454	E. Frank Coe's Red Brand Excelsior Guano .....	Portland .....
2455	E. Frank Coe's Special Potato Fertilizer .....	Bangor .....
2550	E. Frank Coe's Special Potato Fertilizer .....	Portland .....
2456	E. Frank Coe's Standard Grade Am'd Bone Superphosphate CROCKER FERT. & CHEM. CO., BUFFALO, N. Y.	Bangor .....
2457	Crocker's Ammoniated Corn Phosphate .....	Belfast .....
2458	Crocker's Grass and Oats Fertilizer .....	Bangor .....
2459	Crocker's New Rival Ammoniated Superphosphate .....	Belfast .....
2460	Crocker's Potato, Hop and Tobacco Phosphate .....	Bangor .....
2551	Crocker's Potato, Hop and Tobacco Phosphate .....	Belfast .....
2461	Crocker's Superior Fertilizer .....	Bangor .....
	CUMBERLAND BONE PHOS. CO., PORTLAND, ME.	
2462	Cumberland Potato Fertilizer .....	Portland .....
2552	Cumberland Potato Fertilizer .....	Bangor .....
2463	Cumberland Seeding Down Manure .....	Bangor .....
2464	Cumberland Superphosphate .....	Bangor .....
	L. B. DARLING FERTILIZER CO., PAWTUCKET, R. I.	
2465	Darling's Blood, Bone and Potash .....	Houlton .....
	HENRY ELWELL & CO., NEW YORK, N. Y.	
2466	Elwell's Excelsior Potato Guano .....	Presque Isle ...
	GREAT EASTERN FERTILIZER CO., RUTLAND, VT.	
2467	Great Eastern Dissolved Bone .....	Bangor .....
2468	Great Eastern General Fertilizer .....	Bangor .....
2469	Great Eastern Grass and Oats Fertilizer .....	Belfast .....
2470	Great Eastern High Grade Potato Manure .....	Caribou .....
2471	Great Eastern Northern Corn Special .....	Belfast .....
2472	Great Eastern Potato Manure .....	Bangor .....
2553	Great Eastern Potato Manure .....	Belfast .....
	LISTER'S AGRICUL. CHEM. WORKS, NEWARK, N. J.	
2480	Lister's High Grade Special for Spring Crops .....	Portland .....
2481	Lister's Seeding Down Fertilizer .....	Portland .....
2482	Lister's Special Potato Fertilizer .....	Bangor .....
2554	Lister's Special Potato Fertilizer .....	Portland .....
2483	Lister's Success Fertilizer .....	Bangor .....
2484	Lister's U. S. Superphosphate .....	Bangor .....
	LOWELL FERTILIZER CO., BOSTON, MASS.	
2473	Swift's Lowell Animal Fertilizer .....	Bangor .....
2474	Swift's Lowell Bone Fertilizer .....	Portland .....
2475	Swift's Lowell Dissolved Bone and Potash .....	Bangor .....
2476	Swift's Lowell Fruit and Vine Fertilizer .....	Portland .....
2477	Swift's Lowell Ground Bone .....	Bangor .....
2478	Swift's Lowell Potato Manure .....	Portland .....
2479	Swift's Lowell Potato Phosphate .....	Portland .....

## ANALYSES OF STATION SAMPLES, 1900.

Station Number.	NITROGEN.				PHOSPHORIC ACID.								POTASH.	
	Soluble in water.	Insoluble in water.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.	
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.			
	%	%	%	%	%	%	%	%	%	%	%	%	%	
2448	1.57	1.54	3.11	2.40	5.69	1.71	2.20	7.40	7.00	9.60	9.00	†*7.55	8.00	
2549	1.48	1.02	2.50	2.40	6.00	2.04	2.50	8.04	7.00	10.54	9.00	†*7.59	8.00	
2449	.97	1.00	1.97	1.85	6.86	1.82	1.80	†8.68	9.00	10.48	11.00	2.72	2.50	
2450	1.32	1.14	2.46	2.40	5.75	2.24	2.13	7.99	7.00	10.12	9.00	*6.70	6.50	
2451	.50	.46	.96	.80	4.84	3.60	3.07	8.44	7.50	11.51	8.00	3.18	3.00	
2452	.35	.68	1.03	.80	5.97	3.10	1.61	9.07	7.50	10.68	8.00	3.61	3.00	
2453	.....	.....	.....	.....	6.76	3.60	3.35	†10.36	10.50	13.71	12.00	2.26	2.00	
2454	2.45	.98	3.43	3.40	6.41	2.15	1.93	†8.56	9.00	10.49	10.00	*6.31	6.00	
2455	1.24	.54	1.78	1.60	6.61	2.08	2.17	8.69	8.00	10.86	10.00	†*3.79	4.00	
2556	.88	.90	1.78	1.60	6.62	1.97	1.97	8.59	8.00	10.56	10.00	†*3.89	4.00	
2456	.13	1.24	1.37	1.20	6.96	2.93	2.70	9.89	8.00	12.59	10.00	2.66	2.25	
2457	1.51	.64	2.15	2.05	6.78	2.27	1.55	9.05	8.00	10.60	9.00	2.00	1.50	
2458	.....	.....	.....	.....	6.91	3.38	1.38	†10.29	11.00	11.67	12.00	2.11	2.00	
2459	.07	.96	1.03	1.03	6.47	3.17	2.24	9.64	8.00	11.88	9.00	2.06	2.00	
2460	1.08	.90	†1.98	2.05	6.27	2.76	1.72	9.03	8.00	10.75	9.00	3.26	3.25	
2551	.67	1.14	†1.81	2.05	6.42	2.57	2.17	8.99	8.00	11.16	10.00	3.42	3.25	
2461	.02	.98	1.00	.82	3.93	3.82	2.01	†7.75	8.00	9.76	9.00	†1.82	2.00	
2462	1.13	.78	†1.91	2.06	6.18	2.56	1.68	8.74	8.00	10.42	9.00	3.17	3.00	
2552	1.12	1.12	2.24	2.06	6.09	3.12	2.34	9.21	8.00	11.55	9.00	3.15	3.00	
2463	.....	1.24	1.24	1.03	6.85	1.84	1.62	8.69	8.00	10.31	10.00	2.27	2.00	
2464	.....	2.14	2.14	2.06	4.85	4.20	2.33	9.05	8.00	11.38	9.00	2.32	1.50	
2465	3.18	.60	†3.78	4.10	4.59	3.58	1.39	8.17	7.00	9.56	8.00	7.24	7.00	
2466	2.12	.54	†2.66	2.88	4.34	1.79	.35	6.13	5.50	6.48	.....	10.68	10.00	
2467	.....	.....	.....	.....	8.48	4.67	.93	†13.15	14.00	14.08	14.00	.....	.....	
2468	.02	1.00	1.02	.82	4.73	4.18	2.63	8.91	8.00	11.54	8.00	†3.71	4.00	
2469	.....	.....	.....	.....	6.54	3.63	1.81	†10.17	11.00	11.98	11.00	†1.97	2.00	
2470	2.13	1.12	*3.25	3.29	3.70	3.28	2.12	6.98	6.00	9.10	7.00	†9.58	10.00	
2471	1.16	.96	2.12	2.06	6.06	2.98	1.86	9.04	8.00	10.90	8.00	1.51	1.50	
2472	.74	1.20	†1.94	2.06	5.94	2.87	1.95	8.81	8.00	10.76	8.00	3.38	3.25	
2553	1.08	.92	†2.00	2.06	6.17	2.71	2.38	8.88	8.00	11.26	8.00	†3.14	3.25	
2480	.80	1.08	1.88	1.85	5.24	3.22	3.11	†8.46	8.50	11.57	10.00	10.02	10.00	
2481	.43	.38	.81	.62	8.29	3.85	1.11	12.14	10.00	13.25	11.00	1.05	1.00	
2482	.87	.82	1.69	1.65	4.57	3.87	3.23	8.44	8.00	11.67	9.00	†2.90	3.00	
2554	.64	1.20	1.84	1.65	4.85	4.60	3.18	9.45	8.00	12.63	9.00	3.06	3.00	
2483	.58	.86	1.44	1.24	6.59	3.30	1.93	9.89	9.50	11.82	11.50	8.10	2.00	
2484	.12	1.30	1.42	1.32	3.03	4.72	3.04	7.75	7.00	10.79	8.00	2.37	2.00	
2473	1.52	1.12	2.64	2.46	3.55	6.09	1.86	9.61	9.00	11.50	10.00	4.13	4.00	
2474	.79	.96	1.75	1.64	4.36	3.71	2.87	8.07	8.00	10.94	9.00	3.35	3.00	
2475	.20	1.68	1.88	1.64	6.01	3.40	1.93	9.41	9.00	11.34	10.00	2.39	2.00	
2476	1.73	1.46	†3.19	3.29	5.43	3.56	1.03	8.99	7.00	10.02	8.00	6.48	6.00	
2477	.48	1.56	†2.04	2.46	.....	.....	.....	.....	.....	28.76	22.90	.....	.....	
2478	.14	1.70	1.84	1.64	3.92	3.07	2.94	†6.99	7.00	9.93	8.00	*4.01	4.00	
2479	1.28	1.26	2.54	2.46	4.72	3.55	3.10	8.27	8.00	11.37	9.00	*7.03	6.00	

\* Potash largely sulphate.

† Below guarantee.

## DESCRIPTIVE LIST OF STATION SAMPLES, 1900.

Station number.	Manufacturer, place of business and brand.	Sampled at
	<b>NATIONAL FERTILIZER CO., BRIDGEPORT, CONN.</b>	
2485	Chittenden's Ammoniated Bone Phosphate .....	Presque Isle....
2486	Chittenden's Complete Fertilizer .....	Fort Fairfield..
2487	Chittenden's Market Garden Fertilizer .....	Presque Isle....
	<b>NEW ENGLAND FERTILIZER CO., BOSTON, MASS.</b>	
2488	New England Corn Phosphate .....	Bangor .....
2489	New England Potato Fertilizer .....	Portland .....
2558	New England Potato Fertilizer .....	Bangor .....
	<b>S. G. OTIS, HALLOWELL, MAINE.</b>	
2490	Otis Potato Fertilizer .....	Houlton .....
2491	Otis Seeding Down Fertilizer .....	Skowhegan .....
2492	Otis Superphosphate .....	North Deering..
	<b>PACIFIC GUANO CO., BOSTON, MASS.</b>	
2493	Pacific Guano Co.'s Grass and Grain Fertilizer .....	Bangor .....
2494	Pacific Guano Co.'s Nobsque Guano .....	Portland .....
2495	Pacific Guano Co.'s Potato Special .....	Bangor .....
2496	Pacific Guano Co.'s Soluble Pacific Guano .....	Portland .....
	<b>PACKERS' UNION FERTILIZER CO., NEW YORK, N. Y.</b>	
2497	Packers' Union Animal Corn Fertilizer .....	Eddington.....
2498	Packers' Union Economical Vegetable Guano .....	Eddington.....
2499	Packers' Union High Grade Potato Manure .....	Eddington .....
2500	Packers' Union Universal Fertilizer .....	Eddington .....
2555	Packers' Union Universal Fertilizer .....	Bangor .....
2501	Packers' Union Wheat, Oats and Clover Fertilizer .....	Eddington .....
	<b>PARMENTER &amp; POLSEY FER. CO., PEABODY, MASS.</b>	
2502	Parmenter & Polsey Fertilizer Co.'s Special Potato Fertilizer .....	Presque Isle ...
2503	Plymouth Rock Brand .....	Caribou .....
2504	P. and P. Potato Fertilizer .....	Presque Isle ...
2505	Star Brand Superphosphate .....	Augusta .....
	<b>EDWIN J. PHILBRICK, AUGUSTA, MAINE.</b>	
6	Philbrick's Fertilizer .....	Augusta .....
	<b>PORTLAND RENDERING CO., PORTLAND, MAINE.</b>	
07	Portland Rendering Co.'s Bone Tankage .....	East Deering...
	<b>PROVINCIAL CHEM. FER. CO., LTD, ST. JOHN, N. B.</b>	
2508	Provincial Chemical Fertilizer Co.'s Potato Phosphate .....	Presque Isle ...
	<b>THE QUINNIPIAC CO., BOSTON, MASS.</b>	
2509	Quinnipiac Climax Phosphate .....	Bangor .....
2510	Quinnipiac Corn Manure .....	Portland .....
2511	Quinnipiac Phosphate .....	Bangor .....
2512	Quinnipiac Potato Manure .....	Portland .....
2513	Quinnipiac Potato Phosphate .....	Bangor .....
2514	Quinnipiac Seeding Down Manure .....	Belfast .....
	<b>READ FERTILIZER CO., NEW YORK, N. Y.</b>	
2515	Read's Potato Manure .....	Caribou .....
2516	Read's Practical Potato Special .....	Bucksport .....
2517	Read's Standard Fertilizer .....	Bucksport .....
2518	Read's Sure Catch Fertilizer .....	Bucksport .....
2519	Read's Vegetable and Vine Fertilizer .....	Fort Fairfield ..
2520	Read's Sampson Fertilizer .....	Bucksport .....

## ANALYSES OF STATION SAMPLES, 1900.

Station number.	NITROGEN.				PHOSPHORIC ACID.								POTASH.	
	Soluble in water.	Insoluble in water.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.	
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.			
	%	%	%	%	%	%	%	%	%	%	%	%	%	
2485	.66	1.46	2.12	1.65	3.34	6.47	1.97	9.81	8.00	11.78	10.00	2.25	2.00	
2486	1.05	2.30	3.35	3.30	4.88	2.84	2.29	†7.72	8.00	10.01	10.00	6.14	6.00	
2487	1.01	1.56	2.57	2.45	3.56	2.82	2.10	6.38	6.00	8.48	8.00	5.68	5.00	
2488	.56	1.14	1.70	1.64	4.89	3.90	2.64	8.79	8.00	11.43	9.00	3.31	3.00	
2489	.36	1.26	†1.62	1.64	4.55	2.83	3.00	7.38	7.00	10.38	8.00	*4.00	4.00	
2558	.52	1.49	2.01	1.64	2.18	4.49	1.53	6.67	7.00	8.20	8.00	*4.47	4.00	
2490	1.12	.94	2.06	2.06	5.63	2.91	2.17	8.54	8.00	10.71	10.00	3.16	3.00	
2491	.62	.52	†1.14	1.25	5.57	2.66	2.50	8.23	8.00	10.73	10.00	2.40	2.00	
2492	1.02	1.10	2.12	2.06	6.14	2.22	2.39	8.36	8.00	10.75	10.00	1.75	1.50	
2493	.44	.80	1.24	.82	4.24	4.25	2.38	8.49	7.00	10.87	8.00	1.36	1.00	
2494	.51	.72	1.23	1.03	4.62	3.81	3.33	8.43	8.00	11.76	9.00	2.22	2.00	
2495	1.12	.96	2.08	2.05	5.89	3.11	2.50	9.00	8.00	11.50	9.00	†2.97	3.00	
2496	1.17	.96	2.13	2.06	5.94	2.43	2.33	8.37	8.00	10.70	9.00	1.93	1.50	
2497	1.22	1.40	2.62	2.47	6.62	3.41	1.78	10.03	9.00	11.81	10.00	2.36	2.00	
2498	.51	.70	†1.21	1.25	5.64	3.14	2.69	8.78	6.00	11.47	7.00	3.25	3.00	
2499	1.24	1.06	2.30	2.06	5.86	3.30	1.52	9.16	8.00	10.68	9.00	6.13	6.00	
2500	.71	.42	1.13	.82	5.08	3.64	2.54	8.72	8.00	11.26	9.00	†3.67	4.00	
2555	.57	.70	1.27	.82	4.81	3.71	2.78	8.52	8.00	11.30	9.00	†3.97	4.00	
2501	.....	.....	.....	.....	5.14	5.66	1.73	†10.80	11.00	12.53	12.00	2.14	2.00	
2502	1.79	1.70	3.49	3.29	3.55	6.10	1.17	9.65	8.00	10.82	9.00	7.47	7.00	
2503	1.44	1.46	2.90	2.47	2.81	6.49	1.88	9.30	8.00	11.18	9.00	5.11	4.00	
2504	.79	1.18	1.97	1.64	4.00	3.94	1.42	7.94	6.00	9.36	7.00	†5.66	6.00	
2505	.73	1.22	1.95	1.64	2.81	5.43	1.14	8.24	7.00	9.38	8.00	3.27	2.50	
2506	.61	1.02	†1.63	2.00	3.22	4.40	2.40	7.62	7.00	10.02	9.00	6.34	5.00	
2507	.88	3.96	4.84	4.54	.37	9.27	6.27	9.64	.....	15.91	16.65	.....	.....	
2508	2.33	.88	3.21	2.88	7.45	2.22	3.86	9.67	8.00	13.53	.....	†4.76	6.50	
2509	.37	1.10	1.47	1.03	5.34	3.91	1.83	9.25	8.00	11.08	9.00	2.58	2.00	
2510	1.02	1.10	2.12	2.06	5.41	4.25	2.42	9.66	8.00	12.08	9.00	1.75	1.50	
2511	.94	1.70	2.64	2.47	5.95	3.94	2.09	9.89	9.00	11.98	10.00	2.24	2.00	
2512	1.31	1.18	2.49	2.47	4.20	4.10	.92	8.30	6.00	9.22	7.00	5.50	5.00	
2513	1.00	1.18	2.18	2.05	4.86	5.38	1.48	10.24	8.00	11.72	9.00	3.20	3.00	
2514	.20	1.06	1.26	1.03	5.42	2.55	2.44	†7.97	8.00	10.41	9.00	†1.97	2.00	
2515	1.02	1.34	†2.36	2.47	3.44	3.91	1.47	7.35	6.00	8.82	7.00	10.60	10.00	
2516	.16	.92	1.08	.83	2.45	3.66	.95	6.11	4.00	7.06	5.00	8.29	8.00	
2517	.23	.86	1.09	.83	5.61	2.97	2.35	8.58	8.00	10.93	9.00	4.23	4.00	
2518	.....	.....	.....	.....	2.41	4.20	1.64	†6.61	10.00	8.25	11.00	4.18	2.00	
2519	.82	1.26	2.08	2.05	5.76	2.85	2.34	8.61	8.00	10.95	9.00	†5.85	6.00	
2520	.42	1.44	†1.86	2.05	4.54	2.55	1.60	†7.09	8.00	8.69	9.00	4.61	3.00	

\* Potash largely sulphate.

† Below guarantee.

## DESCRIPTIVE LIST OF STATION SAMPLES. 1900.

Station number.	DESCRIPTIVE LIST OF STATION SAMPLES. 1900.	
	Manufacturer, place of business and brand.	sampled at
<b>THE RUSSIA CEMENT CO., GLOUCESTER, MASS.</b>		
2521	Essex Complete Manure for Corn, Grain and Grass .....	Bangor .....
2522	Essex Complete Manure for Potatoes, Roots and Vegetables..	Bangor .....
2523	Essex Corn Fertilizer .....	Bangor .....
2524	Essex Potato Fertilizer .....	Bangor .....
2525	Essex XXX Fish and Potash .....	Bangor .....
2526	Maine State Grange Chemicals .....	Bowdoinham ..
2527	Maine State Grange Potato Manure .....	Bowdoinham ..
2528	Maine State Grange Seeding Down Fertilizer .....	Bowdoinham ..
<b>SAGADAHOC FERTILIZER CO., BOWDOINHAM, ME.</b>		
2529	Dirigo Fertilizer .....	Bangor .....
2530	Merrymeeting Superphosphate .....	Bangor .....
2531	Sagadahoc Special Potato Fertilizer .....	Bangor .....
2536	Sagadahoc Special Potato Fertilizer .....	Bowdoinham ..
2532	Sagadahoc Superphosphate .....	Bangor .....
2537	Sagadahoc Superphosphate .....	Bowdoinham ..
2533	Yankee Fertilizer .....	Bangor .....
<b>STANDARD FERTILIZER CO., BOSTON, MASS.</b>		
2534	Standard A Brand .....	Portland .....
2535	Standard Complete Manure .....	Bangor .....
2536	Standard Fertilizer .....	Portland .....
2537	Standard Guano .....	Bangor .....
2538	Standard Special for Potatoes .....	Bangor .....
<b>JOHN WATSON, HOULTON, MAINE.</b>		
2539	Watson's Improved High Grade Potato Manure .....	Houlton .....
<b>WILLIAMS &amp; CLARK FERTILIZER CO., BOSTON, MASS.</b>		
2540	Americus Ammoniated Bone Superphosphate .....	Portland .....
2541	Americus Corn Phosphate .....	Bangor .....
2542	Americus Potato Manure .....	Portland .....
2543	Royal Bone Phosphate for All Crops .....	Bangor .....
2544	Williams & Clark Fertilizer Co.'s Potato Phosphate .....	Portland .....

## ANALYSES OF STATION SAMPLES, 1900.

Station number.	NITROGEN.				PHOSPHORIC ACID.								POTASH.	
	Soluble in water.	Insoluble in water.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.	
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.			
	%	%	%	%	%	%	%	%	%	%	%	%	%	
2521	.94	2.90	3.84	3.70	2.88	5.59	2.43	8.47	7.00	10.90	9.50	10.11	9.50	
2522	.54	3.42	3.96	3.70	3.19	4.96	2.88	8.15	7.00	11.03	9.00	*8.69	8.50	
2523	.59	1.54	2.13	2.00	1.68	7.09	5.11	†8.77	9.00	13.88	10.50	3.41	3.00	
2524	.47	1.56	2.03	2.00	2.45	6.51	4.52	†8.96	9.00	13.48	10.50	6.27	5.00	
2525	.86	1.90	2.76	2.10	2.85	6.71	5.87	9.56	9.00	15.43	12.00	2.82	2.25	
2526	1.14	1.70	2.84	2.50	2.91	6.44	4.60	9.35	8.00	13.95	12.00	5.44	4.00	
2527	.90	.78	1.68	1.50	3.40	7.56	3.24	10.96	9.00	14.20	12.00	†11.16	12.00	
2528	.16	1.44	1.60	1.50	1.52	5.34	7.17	†6.86	7.00	14.03	13.00	†5.47	5.50	
2529	.18	1.40	1.58	1.50	1.39	4.73	3.80	6.12	3.50	9.92	9.00	4.23	3.75	
2530	.83	.46	1.29	1.20	2.03	5.58	3.03	7.61	5.00	10.64	9.00	3.14	2.00	
2531	.33	1.08	†1.41	2.40	5.69	3.59	.62	9.28	6.50	9.90	9.50	9.64	7.00	
2556	.78	.68	†1.46	2.40	5.81	3.55	.64	9.36	6.50	10.00	9.50	9.73	7.00	
2532	.94	.98	†1.92	2.05	2.85	5.64	2.51	8.49	6.50	11.00	10.00	4.21	4.00	
2557	.84	.96	†1.80	2.05	3.77	5.30	2.08	9.07	6.50	11.15	10.00	4.60	4.00	
2533	.56	.46	1.02	.40	1.27	3.93	.66	†5.20	5.50	5.86	7.00	4.90	1.50	
2534	.50	.78	1.28	.82	2.99	4.98	3.42	7.97	7.00	11.39	9.00	1.58	1.00	
2535	2.48	.86	3.34	3.30	4.00	4.30	1.91	8.30	8.00	10.21	9.00	7.15	7.00	
2536	1.10	1.22	2.32	2.06	5.70	3.18	2.12	8.88	8.00	11.00	9.00	2.69	1.50	
2537	.57	.66	1.23	1.03	4.56	3.85	2.28	8.41	8.00	10.69	9.00	2.33	2.00	
2538	.94	1.26	2.20	2.05	5.69	3.79	2.12	9.48	8.00	11.60	9.00	3.14	3.00	
2539	1.12	1.60	†2.72	3.00	.67	5.17	1.95	†5.84	6.00	7.79	7.00	†4.97	5.00	
2540	1.38	1.20	2.58	2.47	5.67	4.00	1.90	9.67	9.00	11.57	10.00	2.49	2.00	
2541	.62	1.58	2.20	2.06	5.89	3.55	2.05	9.44	8.00	11.49	9.00	1.94	1.50	
2542	1.00	1.10	2.10	2.06	5.21	3.57	2.15	8.78	8.00	10.93	9.00	3.42	3.00	
2543	.38	.72	1.10	1.03	5.80	3.62	1.84	9.42	8.00	11.26	9.00	2.63	2.00	
2544	1.24	1.12	†2.36	2.47	3.82	2.32	2.53	6.14	6.00	8.67	7.00	5.94	5.00	

\* Potash largely sulphate.

† Below guarantee.

DESCRIPTIVE LIST OF STATION SAMPLES, 1900, CARRYING ON THE  
 PACKAGE A GUARANTEED ANALYSIS DIFFERING FROM THE CERTI-  
 FIED STATEMENT FILED WITH THE STATION DIRECTOR.

Station number.	Brand.	Sampled at
2408	Blanchard's Fish, Bone and Potash .....	Houlton .....
2409	Blanchard's Grass and Grain Fertilizer.....	Eastport .....
2410	Blanchard's Ground Fish Scrap .....	Eastport .....
2411	Bowker's Corn Phosphate.....	Bangor .....
2413	Bowker's Farm and Garden Phosphate.....	Portland .....
2415	Bowker's Hill and Drill Phosphate .....	Bangor .....
2417	Bowker's Potato and Vegetable Fertilizer.....	Bangor .....
2418	Bowker's Potato and Vegetable Phosphate .....	Belfast .....
2423	Bowker's Ten Per Cent Manure .....	Houlton .....
2425	Stockbridge Corn and Grain Manure.....	Portland .....
2426	Stockbridge Pea and Bean Manure .....	Bangor .....
2427	Stockbridge Potato and Vegetable Manure.....	Portland .....
2545	Stockbridge Potato and Vegetable Manure .....	Bangor .....
2428	Stockbridge Seeding Down Manure.....	Bangor .....
2432	Bradley's Niagara Phosphate.....	Bangor .....
2437	Bay State Fertilizer G. G .....	Bangor .....
2444	Cleveland Superphosphate .....	Portland .....
2445	E. Frank Coe's Celebrated Special Grass and Grain Fertilizer .....	Bangor .....
2446	E. Frank Coe's Columbian Corn Fertilizer .....	Portland .....
2447	E. Frank Coe's Columbian Potato Fertilizer .....	Bangor .....
2448	E. Frank Coe's Excelsior Potato Fertilizer.....	Portland .....
2449	E. Frank Coe's High Grade Ammoniated Bone Superphosphate .....	Portland .....
2450	E. Frank Coe's High Grade Potato Fertilizer .....	Bangor .....
2451	E. Frank Coe's New Englander Corn Fertilizer .....	Portland .....
2452	E. Frank Coe's New Englander Potato Fertilizer.....	Bangor .....
2453	E. Frank Coe's Prize Brand Grain and Grass Fertilizer.....	Portland .....
2454	E. Frank Coe's Red Brand Excelsior Guano.....	Portland .....
2455	E. Frank Coe's Special Potato Fertilizer .....	Bangor .....
2550	E. Frank Coe's Special Potato Fertilizer .....	Portland .....
2456	E. Frank Coe's Standard Grade Am'd Bone Superphosphate..	Bangor .....
2457	Crocker's Ammoniated Corn Phosphate .....	Belfast .....
2460	Crocker's Potato, Hop and Tobacco Phosphate.....	Bangor .....
2551	Crocker's Potato, Hop and Tobacco Phosphate .....	Belfast .....
2462	Cumberland Potato Fertilizer .....	Portland .....
2552	Cumberland Potato Fertilizer .....	Bangor .....
2464	Cumberland Superphosphate .....	Bangor .....
2466	Elwell's Excelsior Potato Guano.....	Presque Isle ..
2467	Great Eastern Dissolved Bone ...	Bangor .....
2468	Great Eastern General Fertilizer.....	Bangor .....
2469	Great Eastern Grass and Oats Fertilizer.....	Belfast .....
2471	Great Eastern Northern Corn Special .....	Belfast .....
2472	Great Eastern Potato Manure .....	Bangor .....

ANALYSIS OF STATION SAMPLES, 1900, CARRYING ON THE PACKAGE  
A GUARANTEED ANALYSIS DIFFERING FROM THE CERTIFIED STATE  
MENT FILED WITH THE STATION DIRECTOR.

Station number.	NITROGEN.			AVAILABLE PHOSPHORIC ACID.			TOTAL PHOSPHORIC ACID.			POTASH.		
	Found.	Guarantee on certificate.	Guarantee on bag.	Found.	Guarantee on certificate.	Guarantee on bag.	Found.	Guarantee on certificate.	Guarantee on bag.	Found.	Guarantee on certificate.	Guarantee on bag.
	%	%	%	%	%	%	%	%	%	%	%	%
2408	3.40	3.00	4.47	3.22	3.00	*	3.53	4.00	5.15	3.15	3.00	6.00
2409	3.80	4.47	4.47	3.41	3.00	*	4.06	4.28	5.15	1.30	2.00	3.00
2410	3.68	4.00	4.47	3.65	3.00	*	4.18	4.00	5.15	.89	1.00	*
2411	1.63	1.60	1.50	8.32	7.00	8.00	10.22	9.00	10.00	2.49	2.00	2.00
2413	1.66	1.50	1.50	9.74	8.00	9.00	12.19	10.00	11.00	2.26	2.00	2.00
2415	2.26	2.25	2.10	8.90	9.00	9.00	11.48	12.00	12.00	2.30	2.00	2.00
2417	2.51	2.25	2.25	9.62	8.00	9.00	12.52	10.00	11.00	4.58	4.00	4.00
2418	1.66	1.50	1.50	10.48	8.00	8.00	12.60	10.00	11.00	2.34	2.00	2.00
2423	.82	.75	.82	6.98	6.00	6.00	10.38	8.00	8.00	10.44	10.00	10.00
2425	3.02	3.00	3.00	9.89	8.00	7.00	11.11	10.00	10.00	7.07	6.00	6.00
2426	2.20	2.00	2.00	7.16	6.00	6.00	11.28	8.00	*	11.59	6.00	6.00
2427	2.84	3.25	3.20	7.16	6.00	6.00	8.65	7.00	8.00	9.92	10.00	10.00
2545	3.36	3.25	3.20	7.86	6.00	6.00	9.13	7.00	8.00	10.23	10.00	10.00
2428	2.05	2.50	2.25	8.01	6.00	8.00	10.70	10.00	10.00	10.22	10.00	10.00
2432	1.15	.82	.82	8.31	7.00	7.00	10.00	8.00	8.00	1.35	1.08	1.00
2437	2.17	2.06	1.85	9.65	8.00	8.50	12.08	9.00	10.00	2.08	1.50	2.00
2444	2.07	2.03	2.03	8.68	8.00	8.00	10.98	9.00	10.00	1.87	1.50	1.50
2445	1.08	.80	.80	9.96	8.50	9.00	12.40	*	10.00	2.08	1.25	1.25
2446	1.19	1.20	1.20	9.06	8.50	8.50	12.35	*	9.50	2.55	2.50	2.50
2447	1.42	1.20	1.20	9.24	8.50	8.00	11.75	*	10.00	2.81	2.50	2.50
2448	3.11	2.40	2.50	7.40	7.00	8.00	9.60	*	9.00	7.55	8.00	8.00
2449	1.97	1.85	1.85	8.68	9.00	9.00	10.48	*	11.00	2.72	2.25	2.25
2450	2.46	2.40	2.40	7.99	7.00	7.00	10.12	*	9.00	6.70	6.50	6.50
2451	.96	.80	.80	8.44	7.50	7.50	11.51	*	8.00	3.18	3.00	3.00
2452	1.03	.80	.80	9.07	7.50	7.00	10.68	*	8.00	3.61	3.00	3.00
2453	.....	.....	.....	10.36	10.50	10.50	13.71	*	12.00	2.26	2.00	2.00
2454	3.43	3.40	3.50	8.56	9.00	9.00	10.49	*	10.00	6.31	6.00	6.25
2455	1.78	1.60	1.65	8.69	8.00	8.00	10.86	*	10.00	3.79	4.00	4.00
2550	1.78	1.60	1.50	8.59	8.00	8.00	10.56	10.00	10.50	3.89	4.00	4.00
2456	1.37	1.20	1.25	9.89	8.00	9.00	12.59	*	10.00	2.66	2.25	2.25
2457	2.15	2.05	2.05	9.05	8.00	8.00	10.60	9.00	10.00	2.00	1.50	1.50
2460	1.98	2.05	2.05	9.03	8.00	8.00	10.75	9.00	10.00	3.26	3.25	3.00
2551	1.81	2.05	2.05	8.99	8.00	8.00	11.16	10.00	10.00	3.42	3.25	3.00
2462	1.91	2.06	2.06	8.74	8.00	8.00	10.42	9.00	10.00	3.17	3.00	3.00
2552	2.24	2.06	2.06	9.21	8.00	9.00	11.55	9.00	11.00	3.15	3.00	3.00
2464	2.14	2.06	2.06	9.05	8.00	8.00	11.38	9.00	10.00	2.32	1.50	1.50
2466	2.66	2.88	2.88	6.13	5.50	5.50	6.48	*	*	10.68	10.00	10.00
2467	.....	.....	.....	13.15	14.00	14.00	14.08	14.00	16.00	.....	.....	.....
2468	1.02	.82	.82	8.91	8.00	8.00	11.54	8.00	10.00	3.71	4.00	4.00
2469	.....	.....	.....	10.17	11.00	11.00	11.98	11.00	12.00	1.97	2.00	2.00
2471	2.12	2.06	2.06	9.04	8.00	8.00	10.98	8.00	9.00	1.51	1.50	1.50
2472	1.94	2.06	2.00	8.81	8.00	8.00	10.76	8.00	10.00	3.38	3.25	3.00

\* Not guaranteed.

DESCRIPTIVE LIST OF STATION SAMPLES, 1900, CARRYING ON THE PACKAGE A GUARANTEED ANALYSIS DIFFERING FROM THE CERTIFIED STATEMENT FILED WITH THE STATION DIRECTOR.

Station number.	Brand.	Sampled at
2553	Great Eastern Potato Manure. ....	Belfast .....
2476	Swift's Lowell Fruit and Vine Fertilizer .....	Portland .....
2477	Swift's Lowell Ground Bone .....	Bangor .....
2485	Chittenden's Ammoniated Bone Phosphate.....	Presque Isle ...
2486	Chittenden's Complete Fertilizer .....	Fort Fairfield..
2496	Pacific Guano Co.'s Soluble Pacific Guano. ....	Portland .....
2506	Philbrick's Fertilizer .....	Augusta .....
2507	Portland Rendering Co.'s Bone Tankage .....	East Deering..
2508	Provincial Chemical Fertilizer Co.'s Potato Phosphate .....	Presque Isle ...
2509	Quinnipiac Climax Phosphate .....	Bangor .....
2510	Quinnipiac Corn Manure .....	Portland .....
2518	Read's Sure Catch Fertilizer .....	Bucksport.....
2519	Read's Vegetable and Vine Fertilizer .....	Fort Fairfield..
2520	Read's Sampson Fertilizer .....	Bucksport.....
2521	Essex Complete Manure for Corn, Grain and Grass .....	Bangor .....
2523	Essex Corn Fertilizer.....	Bangor .....
2524	Essex Potato Fertilizer.....	Bangor .....
2529	Dirigo Fertilizer .....	Bangor .....
2530	Merrymeeting Superphosphate .....	Bangor .....
2531	Sagadahoc Special Potato Fertilizer .....	Bangor .....
2556	Sagadahoc Special Potato Fertilizer .....	Bowdoinham ..
2532	Sagadahoc Superphosphate .....	Bangor .....
2557	Sagadahoc Superphosphate .....	Bowdoinham ..
2533	Yankee Fertilizer .....	Bangor .....
2536	Standard Fertilizer .....	Portland .....
2537	Standard Guano.....	Bangor .....
2541	Americus Corn Phosphate .....	Bangor .....
2543	Royal Bone Phosphate for All Crops. ....	Bangor .....

ANALYSIS OF STATION SAMPLES, 1900, CARRYING ON THE PACKAGE  
A GUARANTEED ANALYSIS DIFFERING FROM THE CERTIFIED STATE-  
MENT FILED WITH THE STATION DIRECTOR.

Station number.	NITROGEN.			AVAILABLE PHOSPHORIC ACID.			TOTAL PHOSPHORIC ACID.			POTASH.		
	Found.	Guarantee on certificate.	Guarantee on bag.	Found.	Guarantee on certificate.	Guarantee on bag.	Found.	Guarantee on certificate.	Guarantee on bag.	Found.	Guarantee on certificate.	Guarantee on bag.
	%	%	%	%	%	%	%	%	%	%	%	%
2553	2.00	2.06	2.06	8.88	8.00	8.00	11.26	8.00	9.00	3.14	3.25	3.25
2476	3.19	3.29	* 2.47	8.99	7.00	8.00	10.62	8.00	9.00	6.48	6.00	6.00
2477	2.04	2.46	*	.....	5.00	*	28.76	22.90	*	.....	.....	.....
2485	2.12	1.65	1.85	9.81	8.00	7.00	11.78	10.00	9.00	2.25	2.00	2.00
2486	3.35	3.30	3.70	7.72	8.00	8.00	10.01	10.00	10.00	6.14	6.00	6.00
2496	2.13	2.06	2.06	8.37	8.00	8.00	10.70	9.00	10.00	1.93	1.50	1.50
2506	1.63	2.00	2.50	7.62	7.00	7.00	10.02	9.00	9.00	6.34	5.00	6.00
2507	4.84	4.54	*	9.64	*	*	15.91	16.65	*	.....	.....	.....
2508	3.21	2.88	3.09	9.67	8.00	8.00	13.53	*	*	4.76	6.50	6.50
2509	1.47	1.03	1.25	9.25	8.00	8.00	11.08	9.00	9.00	2.58	2.00	2.00
2510	2.12	2.06	2.06	9.66	8.00	8.00	12.08	9.00	10.00	1.75	1.50	1.50
2518	.....	.....	.....	6.61	10.00	6.00	8.25	11.00	7.00	4.18	2.00	4.00
2519	2.08	2.05	1.10	8.61	8.00	8.00	10.95	9.00	9.00	5.85	6.00	6.00
2520	1.86	2.05	1.65	7.09	8.00	6.00	8.69	9.00	7.00	4.61	3.00	4.00
2521	3.84	3.70	3.70	8.47	7.00	7.50	10.90	9.50	10.00	10.11	9.50	9.50
2523	2.13	2.00	2.00	8.77	9.00	9.00	13.88	10.50	11.00	3.41	3.00	3.00
2524	2.03	2.00	2.00	8.96	9.00	9.00	13.48	10.50	11.00	6.27	5.00	5.00
2529	1.58	1.50	2.00	6.12	3.50	*	9.92	9.00	9.00	4.23	3.75	4.50
2530	1.29	1.20	1.25	7.61	5.00	8.00	10.64	9.00	*	3.14	2.00	2.50
2531	1.41	2.40	2.25	9.28	6.50	8.00	9.90	9.50	9.00	9.64	7.00	8.00
2556	1.46	2.40	2.25	9.36	6.50	8.00	10.00	9.50	9.00	9.73	7.00	8.00
2532	1.92	2.05	2.25	8.49	6.50	9.00	11.00	10.00	10.00	4.21	4.00	4.00
2557	1.80	2.05	2.25	9.07	6.50	9.00	11.15	10.00	10.00	4.60	4.00	4.00
2533	1.02	.40	.82	5.20	5.50	*	5.86	7.00	6.00	4.90	1.50	*
2536	2.32	2.06	2.06	8.88	8.00	8.00	11.00	9.00	10.00	2.69	1.50	1.50
2537	1.23	1.03	1.03	8.41	8.00	8.00	10.69	9.00	10.00	2.33	2.00	2.00
2541	2.20	2.06	2.06	9.44	8.00	9.00	11.49	9.00	10.00	1.94	1.50	1.50
2543	1.10	1.00	1.00	9.42	8.00	7.00	11.26	9.00	8.00	2.63	2.00	2.00

\*Not guaranteed.

## DESCRIPTIVE LIST OF MANUFACTURERS' SAMPLES, 1900.\*

Station number.	Manufacturer, place of business and brand.	
	CLARK'S COVE FERTILIZER CO., BOSTON, MASS.	
2390	Defiance Phosphate .....	GREAT EASTERN FERTILIZER CO., RUTLAND, VT.
2395	Great Eastern High Grade Potato Manure .....	
2392	PROVINCIAL CHEMICAL FERTILIZER CO., LIMITED, ST. JOHN, N. B.	
2392	Provincial Chemical Fertilizer Co.'s Potato Phosphate .....	THE QUINNIPIAC CO., BOSTON, MASS.
2393	Quinnipiac Climax Phosphate .....	
	RUSSIAN CEMENT CO., GLOUCESTER, MASS.	
2396	Essex Odorless Lawn Dressing .....	
	STANDARD FERTILIZER CO., BOSTON, MASS.	
2394	Standard Complete Manure .....	

## ANALYSES OF MANUFACTURERS' SAMPLES, 1900.\*

Station number.	NITROGEN.				PHOSPHORIC ACID.								POTASH.	
	Soluble in water.	Insoluble in water.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.	
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.			
2390	% .40	% .68	% 1.08	% .82	% 5.24	% 2.74	% 1.48	% 7.98	% 7.00	% 9.46	% 9.00	% 1.59	% 1.00	
2395	2.38	1.00	3.38	3.29	4.87	3.25	1.86	8.12	6.00	9.98	....	10.64	10.00	
2392	1.99	1.00	2.99	2.88	8.46	1.25	3.64	9.71	8.00	13.35	.....	4.33	6.50	
2393	.39	1.06	1.45	1.03	5.10	3.54	1.63	8.64	8.00	10.27	9.00	2.91	2.00	
2396	3.92	.12	4.04	3.70	1.18	4.98	4.87	6.16	6.00	11.03	7.00	6.54	7.00	
2394	2.40	.90	3.30	3.30	7.02	1.99	1.04	8.81	8.00	9.85	9.00	7.56	7.00	

\* These goods were received after the March Bulletin was issued.

## DIGESTION EXPERIMENTS WITH SHEEP.

J. M. BARTLETT.

Several digestion experiments with sheep have been made since the last work of this nature was published in the Station Report for 1898\*, and the results are presented in the following pages. The larger part of the work was done in 1899, but a few of the experiments were made in 1898 and the early part of 1900. The chief object of the experiments was to determine the nutritive value of the several fodders and feeds used in connection with feeding experiments and growing forage crops.

The method followed was practically the same as has been used heretofore at the Station, namely: Each experiment covered a period of twelve days, the first seven being devoted to preliminary feeding, and the last five to the experiment proper during which time the pouches were attached to the sheep and all the excrement collected, dried, weighed, and sampled for analysis. The rations were uniform and weighed throughout the twelve days. The coarse fodders were finely chopped, thoroughly mixed to make them uniform, and a small sample was taken out each time the sheep were fed to make a composite sample for analysis. In most of the experiments three or four sheep were employed, but in a few cases only two were used. Seven different sheep were used in all. The four used in 1899, not being very satisfactory, were replaced by other strong young wethers in January, 1900.

### MATERIALS FED IN THE EXPERIMENTS.

*Clover hay:* Made largely of alsike clover cut early in July when nearly all the plants were in bloom.

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\* Digestion experiments with sheep have been conducted at this station since 1885, and the results are given in the Reports for 1886, 1887, 1888, 1889, 1890, 1891, 1893, 1894, 1896, 1897 and 1898. The Report for 1891 contains a description of the digestion room, stalls, harness, etc., used in the experiments.

*Clover hay:* Made largely of alsike clover, from same field as the preceding lot, cut about ten days later when many of the plants were past bloom.

*Clover silage:* Made from the late cut clover described above. The material was well preserved in the silo and when fed was in good condition, well relished by the animals.

*Corn meal:* Made from ordinary western corn, rather coarsely ground.

*Oats:* Maine grown, medium quality, fed whole.

*Hay:* Largely timothy, fed with oats.

*Oat and pea hay:* Harvested when oats were in milk. The seeding was  $1\frac{1}{2}$  bushels oats and  $1\frac{1}{2}$  bushels Canada field peas to the acre.

*Oat and pea silage:* Same material as used for the hay, cut when the oats were in the milk and run through the ensilage cutter before putting in the silo.

*Oat and vetch hay:* Made from ordinary oats and sand vetch, *Vicia villosa*, cut when the oats were in milk. Seeding, one bushel oats and one bushel vetch to the acre.

*Oat and vetch hay:* Made from ordinary oats and spring vetch, *Vicia sativa*.

*Oat and pea hay:* Made from ordinary oats and Canada field peas, cut when the oats were in milk. Seeding, one bushel oats and two bushels peas to the acre.

*Hay:* Largely timothy.

*Germ meal:* A corn product resembling gluten feed.

*Oats:* Maine oats of first quality, very plump and heavy, fed whole.

*Royal Oat Feed:* An oat feed put out by the Akron Cereal Company.

*Kentucky Mixed Feed:* Wheat bran, adulterated.

## THE COMPOSITION OF FEEDING STUFFS USED IN DIGESTION EXPERIMENTS IN 1899.

	Station number.	Water.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.
ON FRESH BASIS.							
		%	%	%	%	%	%
Clover cut in early bloom .....	4152	19.21	7.80	12.60	23.36	35.24	1.79
Clover cut in late bloom .....	4156	17.73	6.92	11.99	24.25	36.71	2.40
Clover silage .....	4160	78.84	2.20	2.56	7.87	7.71	.82
Clover hay .....	4163	19.28	7.38	12.08	25.36	34.34	1.56
Hay, mostly timothy .....	4170	11.81	5.92	9.24	26.76	44.12	2.15
Oat and pea hay .....	4174	14.50	7.99	14.41	26.84	33.69	2.57
Oat and pea silage .....	4202	73.80	2.05	3.34	8.75	10.45	1.61
Oat and vetch hay .....	4212	21.08	5.49	7.71	26.12	37.20	2.30
Oat and vetch hay .....	4217	20.00	6.07	8.51	24.93	37.68	2.81
Oat and pea hay .....	4222	25.08	5.93	10.31	25.01	31.45	2.22
Hay, mostly timothy .....	4235	13.00	5.32	6.19	28.21	44.91	2.37
Oats .....	4145	11.15	2.92	12.56	11.28	57.70	4.39
Corn meal .....	4180	14.55	1.60	9.63	2.18	69.17	2.87
Oats .....	4234	13.16	3.15	11.38	10.31	57.06	4.94
Germ meal .....	4227	9.58	3.57	22.94	21.45	32.26	10.20
ON WATER-FREE BASIS.							
Clover hay (cut in early bloom)	4152	.....	9.66	15.59	28.91	43.62	2.22
Clover hay (cut in late bloom)	4156	.....	8.41	14.57	29.47	44.63	2.92
Clover silage .....	4160	.....	10.39	12.10	37.18	36.45	3.88
Clover hay .....	4163	.....	9.14	14.96	31.42	42.55	1.93
Hay, mostly timothy .....	4170	.. ....	6.71	10.49	30.34	50.02	2.44
Oat and pea hay .....	4174	.....	9.35	16.85	31.39	39.41	3.00
Oat and pea silage .....	4202	.....	7.83	12.74	33.40	39.90	6.13
Oat and vetch hay .....	4212	.....	6.95	9.77	33.10	47.26	2.92
Oat and vetch hay .....	4217	.....	7.59	10.64	31.16	47.10	3.51
Oat and pea silage .....	4222	.....	7.91	13.76	33.38	41.99	2.96
Hay, mostly timothy .....	4235	.....	6.11	7.12	32.43	51.62	2.72
Oats ..	4145	.....	3.28	14.09	12.70	64.99	4.94
Corn meal .....	4180	.....	1.87	11.27	2.55	80.95	3.36
Oats ..	4234	.....	3.63	13.10	11.87	65.71	5.69
Germ meal .....	4227	.....	3.95	25.37	23.72	35.68	11.28

## DIGESTION EXPERIMENT 70—CLOVER HAY CUT IN EARLY BLOOM.

## RATIONS.

Fed Sheep I 600 grams per day.

Fed Sheep II 600 grams per day.

Fed Sheep III 600 grams per day.

## COMPOSITION OF FODDER AND FECES.

	Station number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Calories.
FODDER.		%	%	%	%	%	%	%	
Early cut clover.	4152	80.8	90.34	9.66	15.59	28.91	43.62	2.22	4367
FECES.									
Sheep I. ....	4153	.....	86.27	13.73	12.94	32.94	36.69	3.70	4552
Sheep II.....	4154	.....	88.91	11.09	12.80	32.05	40.10	3.96	4719
Sheep III.....	4155	.....	86.80	13.20	11.91	33.56	37.67	3.66	4560

## TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry matter.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
<b>SHEEP I.</b>	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Early cut clover.....	2424.0	2189.8	234.2	377.9	700.8	1057.3	53.8
Feces.....	943.6	814.0	129.6	122.1	310.8	346.2	34.9
Amount digested.....	1480.4	1375.8	104.6	255.8	390.0	711.1	18.9
Per cent digested.....	61.1	62.8	44.7	67.7	55.6	67.3	35.1
<b>SHEEP II.</b>							
Early cut clover.....	2424.0	2189.8	234.2	377.9	700.8	1057.3	53.8
Feces.....	1074.1	955.0	119.1	137.5	344.3	430.7	42.5
Amount digested.....	1349.9	1234.8	115.1	240.4	356.5	626.6	11.3
Per cent digested.....	55.7	56.4	49.1	63.6	50.9	59.3	21.0
<b>SHEEP III.</b>							
Early cut clover.....	2424.0	2189.8	234.2	377.9	700.8	1057.3	53.8
Feces.....	1064.3	923.8	140.5	126.8	357.2	400.9	38.9
Amount digested.....	1359.7	1266.0	93.7	251.1	343.6	656.4	14.9
Per cent digested.....	56.1	57.8	40.0	66.4	49.0	62.1	27.7
Average.....	57.6	59.0	44.6	65.9	51.8	62.9	27.9

## FUEL VALUES FOR FIVE DAYS.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea.	Total available fuel value.	Per cent available fuel value.
<b>FODDER: EARLY CUT CLOVER.</b>						
Sheep I.....	10586	4265	6321	223	6098	57.6
Sheep II.....	10586	5069	5517	209	5308	50.2
Sheep III.....	10586	4853	5733	218	5515	52.1

## DIGESTION EXPERIMENT 71—CLOVER HAY CUT IN LATE BLOOM.

## RATIONS.

Fed Sheep I 600 grams per day.

Fed Sheep II 600 grams per day.

Fed Sheep III 600 grams per day.

## COMPOSITION OF FODDERS AND FECES.

	Station number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDER.		%	%	%	%	%	%	%	
Late cut clover ..	4156	82.3	91.59	8.41	14.57	29.47	44.63	2.92	4350
FECES.									
Sheep I .....	4157	.....	87.78	12.22	11.07	37.52	35.27	3.92	4534
Sheep II .....	4158	.....	87.74	12.26	9.30	38.92	34.78	4.76	4745
Sheep III .....	4159	.....	89.55	10.45	11.82	35.96	37.73	4.04	4563

## TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry matter.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
<b>SHEEP I.</b>	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Late cut clover .....	2469.0	2261.3	207.6	359.7	727.6	1101.9	72.1
Feces.....	1086.5	953.7	132.8	120.3	407.6	383.2	42.6
Amount digested .....	1382.5	1307.6	74.8	239.4	320.0	718.7	29.5
Per cent digested.....	56.0	57.8	36.0	66.5	44.0	65.2	40.9
<b>SHEEP II.</b>							
Late cut clover .....	2469.0	2211.3	207.6	359.7	727.6	1101.9	72.1
Feces.....	1118.1	981.0	137.1	104.0	435.2	388.6	53.2
Amount digested .....	1350.9	1280.3	70.5	255.7	292.4	713.3	18.9
Per cent digested .....	54.7	56.6	34.0	71.1	40.2	64.7	26.2
<b>SHEEP III.</b>							
Late cut clover .....	2469.0	2261.3	207.6	359.7	727.6	1101.9	72.1
Feces .....	1083.0	969.8	113.2	128.0	389.4	408.6	43.8
Amount digested .....	1386.0	1291.5	94.4	231.7	338.2	693.3	28.3
Per cent digested.....	56.1	57.1	45.4	64.4	46.5	62.9	39.2
Average .....	55.6	57.2	38.5	67.3	43.6	64.3	35.4

## FUEL VALUE FOR FIVE DAYS.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea.	Total available fuel value.	Per cent available fuel value.
<b>LATE CUT CLOVER.</b>						
Sheep I .....	10740	4926	5814	198	5616	52.3
Sheep II .....	10740	5305	5435	223	5212	48.5
Sheep III .....	10740	4942	5798	202	5596	52.1

DIGESTION EXPERIMENT 72—CLOVER SILAGE MADE FROM  
CLOVER CUT IN LATE BLOOM.

## RATIONS.

Fed Sheep I 3,000 grams per day.

Fed Sheep II 3,000 grams per day.

Fed Sheep III 3,000 grams per day.

## COMPOSITION OF FODDER AND FECES.

	Laboratory number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
<b>FODDER.</b>		%	%	%	%	%	%		
Clover silage.....	4160	21.2	89.61	10.39	12.10	37.18	36.45	3.88	4652
<b>FECES.</b>									
Sheep I.....	4161	.....	89.36	10.64	15.21	34.63	35.28	4.24	4720
Sheep III.....	4162	.....	86.24	13.76	15.41	35.22	32.37	3.24	4506

## TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry substance.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
<b>SHEEP I.</b>	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Clover silage .....	3180.0	2849.6	330.4	384.8	1182.3	1159.1	123.4
Feces. ....	1523.1	1361.0	162.1	231.7	527.4	537.3	64.6
Amount digested .....	1656.9	1488.6	168.3	153.1	654.9	621.8	58.8
Per cent digested.....	52.1	52.2	50.9	39.8	55.4	53.7	47.7
<b>SHEEP III.</b>							
Clover silage.....	3180.0	2849.6	330.4	384.8	1182.3	1159.1	123.4
Feces. ....	1510.4	1302.6	207.8	232.8	532.0	488.9	48.9
Amount digested.....	1669.6	1547.0	122.6	152.0	650.3	670.2	74.5
Per cent digested.....	52.5	54.3	37.1	39.5	55.0	57.9	60.4
Average. ....	52.3	53.3	44.0	39.7	55.2	55.8	54.1

## FUEL VALUE FOR FIVE DAYS.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea.	Total available fuel value.	Per cent available fuel value.
<b>CLOVER SILAGE.</b>						
Sheep I .....	14793	7199	7594	133	7461	50.4
Sheep III .....	14793	6806	7987	132	7855	53.1

## DIGESTION EXPERIMENT 73—CORN MEAL FED WITH CLOVER HAY.

## RATIONS.

Fed Sheep I corn meal 300 grams, clover 400 grams per day.

Fed Sheep II corn meal 300 grains, clover 400 grams per day.

Fed Sheep III corn meal 300 grams, clover 400 grams per day.

## COMPOSITION OF FODDER AND FECES.

	Station number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDER.		%	%	%	%	%	%	%	
Clover hay .....	4163	80.7	90.86	9.14	14.96	31.42	42.55	1.93	4370
Corn meal .....	4180	85.5	98.13	1.87	11.27	2.55	80.95	3.36	4352
FECES.									
Sheep I.....	4164	.....	88.32	11.68	15.55	32.44	36.53	3.80	4727
Sheep II.....	4165	.....	89.98	10.02	15.68	31.67	39.26	3.37	4649
Sheep III.....	4166	.....	87.54	12.46	12.01	33.56	39.23	2.74	4631

## TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED FOR FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry matter.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.
	Grams	Grams	Grams	Grams	Grams	Grams	Grams
<b>SHEEP I.</b>							
Fed in clover hay.....	1614.0	1466.5	147.5	241.5	507.1	686.8	31.1
Fed in corn meal.....	1282.5	1258.5	24.0	144.5	32.7	1038.2	43.1
Total fed.....	2896.5	2725.0	171.5	386.0	539.8	1725.0	74.2
Total feces.....	815.7	720.4	95.3	126.8	264.6	298.0	31.0
Total digested.....	2080.8	2004.6	76.2	259.2	275.2	1427.0	43.2
Digested from clover hay....	903.8	847.6	53.1	160.6	223.1	447.8	12.7
Digested from corn meal....	1177.0	1157.0	23.1	98.6	52.1	979.2	30.5
Per cent digested from corn meal.....	91.8	91.9	96.2	68.2	.....	94.3	70.8
<b>SHEEP II.</b>							
Fed in clover hay.....	1614.0	1466.5	147.5	241.5	507.1	686.8	31.1
Fed in corn meal.....	1282.5	1258.5	24.0	144.5	32.7	1038.2	43.1
Total fed.....	2896.5	2725.0	171.5	386.0	539.8	1725.0	74.2
Total feces.....	907.8	816.8	91.0	142.3	287.5	356.4	30.6
Total digested.....	1988.7	1908.2	80.5	243.7	252.3	1368.6	43.6
Digested from clover hay....	882.9	830.0	50.2	153.6	203.9	444.4	8.1
Digested from corn meal....	1105.8	1078.2	30.3	90.1	48.4	924.2	35.5
Per cent digested from corn meal.....	86.2	85.7	.....	62.4	.....	89.0	82.3
<b>SHEEP III.</b>							
Fed in clover hay.....	1614.0	1466.5	147.5	241.5	507.1	686.8	31.1
Fed in corn meal.....	1282.5	1258.5	24.0	144.5	32.7	1038.2	43.1
Total fed.....	2896.5	2725.0	171.5	386.0	539.8	1725.0	74.2
Total feces.....	869.6	761.2	108.4	104.5	291.8	341.1	23.8
Total digested.....	2026.9	1963.8	63.1	281.5	248.0	1383.9	50.4
Digested from clover hay....	905.5	837.4	67.0	155.5	235.8	432.0	12.2
Digested from corn meal....	1121.4	1126.4	3.9	126.0	12.2	951.9	38.2
Per cent digested from corn meal.....	87.4	89.5	16.2	87.2	37.3	91.7	88.6
Average.....	88.5	89.0	68.7	72.9	.....	91.7	80.6

## FUEL VALUES FOR FIVE DAYS.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea.	Total available fuel value.	Per cent available fuel value.
<b>CORN MEAL.</b>						
Sheep I.....	5581	572	5009	86	4923	88.2
Sheep II.....	5581	683	4898	78	4820	86.3
Sheep III.....	5581	732	4748	110	4638	83.1

## DIGESTION EXPERIMENT 74—HAY, MOSTLY TIMOTHY.

## RATIONS.

Fed Sheep II 600 grams hay per day.

Fed Sheep IV 500 grams hay per day.

## COMPOSITION OF FODDER AND FECES.

	Station number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDER.		%	%	%	%	%	%	%	
Hay .....	4170	88.2	93.29	6.71	10.49	30.34	50.02	2.44	4487
FECES.									
Sheep II .....	4168	...	92.84	7.16	7.91	38.02	43.82	3.09	4741
Sheep IV .....	4169	.....	92.42	7.58	9.36	36.32	43.45	3.29	4660

## TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED FOR THREE DAYS AND PERCENTAGES DIGESTED.

	Dry matter.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.
SHEEP II.	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Hay .....	2646.0	2468.4	177.6	277.5	802.8	1323.5	64.6
Feces .....	1154.2	1071.6	82.6	91.3	438.8	505.8	35.7
Amount digested.....	1491.8	1396.8	95.0	186.2	364.0	817.7	28.9
Per cent digested.....	56.4	56.6	53.5	67.1	45.3	61.8	44.7
SHEEP IV.							
Hay .....	2205.0	2057.0	148.0	231.3	669.0	1102.9	53.8
Feces .....	908.9	840.0	68.9	85.1	330.1	394.9	29.9
Amount digested.....	1296.1	1217.0	79.1	146.2	338.9	708.0	23.9
Per cent digested.....	58.8	59.2	53.4	63.2	50.7	64.2	44.4
Average .....	57.6	57.9	53.5	65.2	48.0	63.0	44.6

## FUEL VALUE FOR FIVE DAYS.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea.	Total available fuel value.	Per cent available fuel value.
HAY.						
Sheep II.....	11872	5472	6400	162	6238	52.6
Sheep IV.....	9894	4236	5658	126	5532	55.9

## DIGESTION EXPERIMENT 75—OATS FED WITH HAY.

## RATIONS.

Fed Sheep I oats, 400 grams; hay, 200 grams per day.

Fed Sheep I. oats, 400 grams; hay, 200 grams per day.

Fed Sheep III oats, 400 grams; hay, 200 grams per day.

## COMPOSITION OF FODDERS AND FECES.

	Station number.	Total dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Ether extract.	Calories per gram.
FODDERS.									
Hay .....	4170	88.2	96.29	6.71	10.49	30.34	50.02	2.44	4487
Oats .....	4145	88.9	96.72	3.28	14.09	12.70	64.99	4.94	4683
FECES.									
Sheep I. ....	4171	.....	91.01	8.99	11.21	31.04	45.90	2.86	4668
Sheep II. ....	4172	.....	91.68	8.32	8.16	34.10	47.13	2.29	4542
Sheep III. ....	4173	.....	90.69	9.31	11.24	30.84	45.77	2.84	4728

## TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED FOR FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry substance.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
	Grams	Grams	Grams	Grams	Grams	Grams	Grams
<b>SHEEP I.</b>							
Fed in hay .....	882.0	822.8	59.2	92.5	267.6	441.2	21.5
Fed in oats .....	1778.0	1719.7	58.3	250.5	225.8	1155.5	87.9
Total fed .....	2660.0	2542.5	117.5	343.0	493.4	1596.7	109.4
Total feces .....	884.5	805.0	79.5	99.2	274.5	406.0	25.3
Total digested .....	1775.5	1737.5	38.0	243.8	218.9	1190.7	84.1
Digested from hay .....	508.0	476.4	31.7	60.3	128.4	278.0	95.9
Digested from oats .....	1267.5	1261.1	6.3	183.5	90.5	912.7	.....
Per cent digested from oats..	71.3	73.3	10.8	73.2	40.1	78.9	.....
<b>SHEEP II.</b>							
Fed in hay .....	882.0	822.8	59.2	92.5	267.6	441.2	21.5
Fed in oats .....	1778.0	1719.7	58.3	250.5	225.8	1155.5	87.9
Total fed .....	2660.0	2542.5	117.5	343.0	493.4	1596.7	109.4
Total feces .....	972.7	891.8	80.9	79.4	331.7	458.4	22.3
Total digested .....	1687.3	1650.7	36.6	263.6	161.7	1138.3	87.1
Digested from hay .....	508.0	476.4	31.7	60.3	128.4	278.0	95.9
Digested from oats .....	1179.3	1174.3	4.9	203.3	33.3	860.3	.....
Per cent digested from oats..	66.3	68.3	8.4	81.1	14.7	74.5	.....
<b>SHEEP III.</b>							
Fed in hay .....	882.0	822.8	59.2	92.5	267.6	441.2	21.5
Fed in oats .....	1778.0	1719.7	58.3	250.5	225.8	1155.5	87.9
Total fed .....	2660.0	2542.5	117.5	343.0	493.4	1596.7	109.4
Total feces .....	908.6	824.0	84.6	102.1	280.2	415.9	25.8
Total digested .....	1751.4	1718.5	32.9	240.9	213.2	1180.8	83.6
Digested from hay .....	508.0	476.4	31.7	60.3	128.4	278.0	95.9
Digested from oats .....	1243.4	1242.1	1.2	180.6	84.8	902.8	.....
Per cent digested from oats..	69.9	72.2	2.1	72.1	37.6	78.1	.....
Average (%).....	69.2	71.3	5.7	75.5	30.8	77.2	.....

## FUEL VALUE FOR FIVE DAYS.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea, etc.	Total available fuel value.	Per cent available fuel value.
Sheep I .....	8326	2364	5962	160	5802	69.7
Sheep II .....	8326	2653	5673	177	5496	60.1
Sheep III .....	8326	2531	5795	157	5638	61.7

## DIGESTION EXPERIMENT 76—OAT AND PEA HAY.

## RATIONS.

Fed Sheep I 600 grams per day.

Fed Sheep II 600 grams per day.

Fed Sheep III 400 grams per day.

Fed Sheep IV 400 grams per day.

## WASTE LEFT BY EACH SHEEP FOR FIVE DAYS.

Sheep I.	Sheep II.	Sheep III.	Sheep IV.
251 grams.	291 grams.	257 grams.	167 grams.

## COMPOSITION OF WASTE.

Water.	Ash.	Protein.	Nitrogen-free extract.	Fiber.	Fat.
24.54	6.99	4.58	29.99	32.85	1.05

## COMPOSITION OF FODDER AND FECES.

	Station number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDER.									
Oat and pea hay.	4174	%	%	%	%	%	%	%	
		85.50	90.65	9.35	16.85	31.39	39.41	3.00	4490
FECES.									
Sheep I .....	4176	.....	89.54	10.46	12.16	32.51	40.77	4.10	4690
Sheep II .....	4177	.....	89.62	10.38	13.13	32.67	39.74	4.08	4702
Sheep III .....	4178	.....	88.45	11.55	15.13	29.23	40.00	4.09	4635
Sheep IV .....	4179	.....	88.81	11.19	15.08	30.65	39.31	3.77	4402

## TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry matter.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.
SHEEP I.	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Oat and pea hay .....	2380.0	2157.3	222.7	421.0	724.7	937.3	74.3
Feces. ....	890.1	797.0	93.1	108.2	289.4	362.9	36.5
Amount digested .....	1489.9	1360.3	129.6	312.8	435.3	574.4	37.8
Per cent digested. ....	62.6	63.1	58.2	74.3	60.1	61.3	50.9
SHEEP II.							
Oat and pea hay. ....	2341.6	2122.5	219.1	418.6	708.0	922.1	73.8
Feces .....	777.0	696.3	80.7	102.0	253.8	308.8	31.7
Amount digested. ....	1564.6	1426.2	138.4	316.6	454.2	613.3	42.1
Per cent digested. ....	66.8	67.2	63.1	75.6	64.1	66.5	57.0
SHEEP III.							
Oat and pea hay .....	1516.0	1374.2	141.9	276.4	452.3	596.9	48.6
Feces .....	562.1	497.2	64.9	85.1	164.3	224.8	23.0
Amount digested .....	953.9	877.0	77.0	191.3	288.0	372.1	25.6
Per cent digested. ....	62.9	64.0	54.4	69.2	63.7	62.3	52.7
SHEEP IV.							
Oat and pea hay. ....	1584.0	1135.8	148.2	280.6	481.9	623.7	49.6
Feces. ....	566.9	503.5	63.4	85.5	173.8	222.8	21.4
Amount digested .....	1017.1	632.3	84.8	195.1	308.1	400.9	28.2
Per cent digested. ....	64.2	55.7	57.2	69.5	63.9	64.3	56.8
Average .....	64.2	62.5	58.2	72.2	63.0	63.7	54.4

## FUEL VALUE FOR FIVE DAYS.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Full value of urea.	Total fuel value.	Per cent fuel value.
PEAS AND OATS.						
Sheep I. ....	10685	4175	6510	272	6238	58.3
Sheep II. ....	10513	3653	6860	275	6585	62.6
Sheep III. ....	6806	2252	4554	166	4388	64.5
Sheep IV. ....	7112	2217	4895	170	4725	67.5

## DIGESTION EXPERIMENT 77—OAT AND PEA SILAGE.

## RATIONS.

Fed Sheep I 2,000 grams per day.

Fed Sheep II 2,000 grams per day.

## WASTE LEFT BY EACH SHEEP FOR FIVE DAYS.

Sheep I.  
1060 grams.Sheep II.  
286 grams.

## COMPOSITION OF WASTE.

Water.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.
75.08	1.92	3.20	9.34	9.03	1.43

## COMPOSITION OF FODDER AND FECES.

	Station number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Ether extract.	Calories.
FODDER.		%	%	%	%	%	%	%	
Oat & pea silage.	4202	26.2	92.17	7.83	12.74	33.40	39.90	6.13	4209
FECES.									
Sheep I . . . . .	4204	.....	88.1	11 90	10.24	35.46	38.54	3.86	4588
Sheep II . . . . .	4205	.....	90.15	9.85	8.61	38.04	40.19	3.31	4588

## TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry matter.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
	Grams	Grams	Grams	Grams	Grams	Grams	Grams
SHEEP I.							
Oat and pea silage .....	2358.0	2173.5	184.5	300.6	787.5	904.5	144.9
Feces.....	751.1	661.7	89.3	77.0	276.3	289.5	29.0
Digested .....	1606.9	1511.8	95.2	223.6	511.2	651.0	115.9
Per cent digested .....	68.1	69.6	51.6	74.4	64.9	69.9	73.1
SHEEP II.							
Oat and pea silage .....	2620.0	2415.0	205.0	334.0	875.0	1045.0	161.0
Feces.....	976.7	880.5	96.2	84.1	371.5	370.3	37.1
Digested .....	1643.3	1534.5	108.8	249.9	503.5	674.7	123.9
Per cent digested .....	62.8	63.5	53.1	74.8	57.6	64.1	76.9
Average per cent .....	65.5	66.6	52.4	74.6	61.3	67.0	75.0

## FUEL VALUE FOR FIVE DAYS.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea.	Total available fuel value.	Per cent available fuel value.
FODDER: OAT AND PEA SILAGE.						
Sheep I .....	9926	3446	6480	195	6285	50.3
Sheep II.....	11027	4481	6546	217	6329	57.4

## DIGESTION EXPERIMENT 78—OAT AND VETCH HAY.

## RATIONS.

Fed Sheep I 500 grams per day.

Fed Sheep II 500 grams per day.

Fed Sheep III 500 grams per day.

## WASTE LEFT BY EACH SHEEP FOR FIVE DAYS.

Sheep I.  
90 grams.Sheep II.  
56 grams.Sheep III.  
108 grams.

## COMPOSITION OF WASTE.

Water.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.
29.8	6.54	4.02	23.0	35.66	.98

## COMPOSITION OF FODDERS AND FECES.

	Station number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Calories.
FODDER.		%	%	%	%	%	%	%	
Oat and vetch hay .....	4212	78.92	93.05	6.95	9.77	33.10	47.26	2.92	4410
FECES.									
Sheep I .....	4213	.....	91.64	8.36	7.98	38.53	42.96	2.17	4742
Sheep II .....	4214	.....	91.17	8.83	7.41	37.23	43.77	2.76	4486

## TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry substance.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
<b>SHEEP I.</b>	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Oat and vetch hay .....	1909.1	1778.0	131.1	189.1	632.2	900.0	56.7
Feces. ....	851.4	780.2	71.1	67.9	328.0	365.8	18.5
Amount digested. ....	1057.7	997.8	59.9	121.2	304.2	534.2	38.2
Per cent digested. ....	55.4	56.1	45.7	64.1	48.1	59.4	67.4
<b>SHEEP II.</b>							
Oat and vetch hay .....	1933.5	1800.1	133.4	190.5	640.2	912.3	57.1
Feces .....	863.9	787.6	76.3	64.0	321.6	378.1	23.9
Amount digested .....	1069.6	1012.5	57.1	126.5	318.6	534.2	33.2
Per cent digested. ....	55.3	56.2	42.8	66.4	49.8	58.5	58.1
Average. ....	55.4	56.2	44.3	65.3	49.0	59.0	62.8

## FUEL VALUES FOR FIVE DAYS.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea.	Total available fuel value.	Per cent available fuel value.
<b>FODDER: OAT AND VETCH HAY.</b>						
Sheep I. ....	8419	4031	4388	106	4282	50.9
Sheep II .....	8527	3872	4655	110	4545	53.3

## DIGESTION EXPERIMENT 79—OAT AND VETCH HAY.

## RATIONS.

Fed Sheep I 500 grams per day.

Fed Sheep II 500 grams per day.

Fed Sheep III 500 grams per day.

## COMPOSITION OF FODDERS AND FECES.

	Station number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Calories.
FODDER.		%	%	%	%	%	%	%	
Oat and vetch hay .....	4217	80.00	92.41	7.59	10.64	31.16	47.10	3.51	4342
FECES.									
Sheep I. ....	4218	.....	92.96	7.04	8.13	37.97	44.46	2.40	4611
Sheep II. ....	4219	.....	92.06	8.00	7.92	39.39	42.44	2.25	4651
Sheep III. ....	4220	.....	92.09	7.91	8.50	35.99	45.32	2.28	4570

## TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry matter.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
<b>SHEEP I.</b>	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Oat and vetch hay.....	1967.6	1818.0	149.6	210.5	610.2	927.6	69.7
Feces .....	851.7	791.7	60.0	69.2	323.4	378.7	20.4
Amount digested .....	1115.9	1026.3	89.6	141.3	286.8	548.9	49.3
Per cent digested.....	56.7	56.5	59.9	67.1	47.0	59.1	70.7
<b>SHEEP II.</b>							
Oat and vetch hay.....	1981.5	1830.9	150.6	211.5	615.8	933.7	69.9
Feces .....	784.5	721.7	62.8	62.1	309.0	332.9	17.7
Amount digested .....	1197.0	1109.2	87.8	149.4	306.8	600.8	52.2
Per cent digested. ....	60.4	60.6	58.3	70.6	49.8	64.4	74.7
<b>SHEEP III.</b>							
Oat and vetch hay .....	2000.0	1848.2	151.8	212.8	623.2	942.0	70.2
Feces .....	734.7	676.6	58.1	62.4	264.4	333.0	16.8
Amount digested .....	1265.3	1171.6	93.7	150.4	358.8	609.0	53.4
Per cent digested .....	63.3	63.4	62.4	70.7	57.6	64.6	76.1
Average .....	60.1	60.2	60.2	69.5	51.5	62.7	73.8

## FUEL VALUE FOR FIVE DAYS.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea.	Total available fuel value.	Per cent available fuel value.
<b>FODDER: OAT AND VETCH HAY.</b>						
Sheep I .....	8543	3927	4616	123	4493	52.6
Sheep II .....	8604	3649	4955	130	4825	56.1
Sheep III .....	8684	3358	5326	131	5195	59.8

## DIGESTION EXPERIMENT 80—OAT AND PEA HAY.

## RATIONS.

Fed Sheep I 500 grams per day.

Fed Sheep II 500 grams per day.

Fed Sheep III 500 grams per day.

## WASTE LEFT BY EACH SHEEP FOR FIVE DAYS.

Sheep I.	Sheep II.	Sheep III.
26 grams.	50 grams.	75 grams.

## COMPOSITION OF WASTE.

Water.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.
41.46	4.39	5.50	22.77	24.63	1.25

## COMPOSITION OF FODDERS AND FECES.

	Laboratory number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDER.		%	%	%	%	%	%	%	
Oat and pea hay.	4222	74.93	92.09	7.91	13.76	33.38	41.99	2.96	4445.
FECES.									
Sheep I. ....	4223	38.22	91.89	8.11	7.28	39.61	42.70	2.30	4575.
Sheep II. ....	4224	35.79	92.10	7.90	9.31	36.09	43.88	2.82	4592
Sheep III. ....	4226	41.89	92.64	7.36	8.74	39.18	42.30	2.42	4650.

## TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry substance.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
<b>SHEEP I.</b>	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Oat and pea hay .....	1856.4	1709.5	146.9	256.2	618.7	779.5	55.0
Feces .....	785.8	722.1	63.7	57.2	311.3	335.5	18.1
Amount digested. ....	2107.6	987.4	83.2	199.0	307.4	444.6	36.9
Per cent digested. ....	57.6	57.8	56.6	77.7	49.7	57.0	67.1
<b>SHEEP II.</b>							
Oat and pea hay .....	1843.3	1697.3	145.9	255.0	613.6	774.0	54.8
Feces .....	812.0	747.9	64.1	75.6	293.1	356.4	22.9
Amount digested. ....	1031.3	949.4	81.8	179.4	320.5	417.6	31.9
Per cent digested.....	55.9	55.9	56.1	70.3	52.2	54.	58.2
<b>SHEEP III.</b>							
Oat and pea hay .....	1826.4	1681.7	144.7	253.4	607.0	766.9	54.4
Feces .....	694.1	643.0	51.1	60.7	271.9	293.6	16.8
Amount digested. ....	1132.3	1038.7	93.6	192.7	325.1	473.3	37.6
Per cent digested.....	62.0	61.8	64.7	76.0	53.6	61.7	69.1
Average. ....	58.5	58.5	59.1	74.7	51.8	57.6	64.8

## FUEL VALUE FOR FIVE DAYS.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea.	Total available fuel value.	Per cent available fuel value.
<b>FODDER: OAT AND PEA HAY.</b>						
Sheep I. ....	8252	3595	4657	173	4484	54.3
Sheep II .....	8194	3729	4465	156	4309	52.6
Sheep III .....	8118	3228	4890	168	4722	58.2

## DIGESTION EXPERIMENT 81—HAY, MOSTLY TIMOTHY.

## RATIONS.

Fed Sheep I 800 grams hay per day.

Fed Sheep II 800 grams hay per day.

Fed Sheep III 800 grams hay per day.

## COMPOSITION OF FODDERS AND FECES.

	Laboratory number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDER.		%	%	%	%	%	%	%	
Hay .....	4240	87.00	93.89	6.11	7.12	32.43	51.62	2.72	4599
FECES.									
Sheep I .....	4241	.....	89.39	10.61	7.93	30.86	47.99	2.61	4530
Sheep II .....	4242	.....	91.00	9.00	6.65	32.68	49.19	2.48	4578
Sheep III. ....	4243	.....	91.05	8.95	7.04	33.31	48.09	2.61	4603

## TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry matter.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.
<b>SHEEP I.</b>	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Hay .....	3480.0	3267.4	212.6	247.8	1128.6	1796.4	94.6
Feces .....	1501.1	1341.8	159.3	119.0	463.2	720.4	39.2
Amount digested .....	1978.9	1925.6	53.3	128.8	665.4	1076.0	55.4
Per cent digested.....	56.8	58.9	25.1	52.0	59.0	59.9	58.6
<b>SHEEP II.</b>							
Hay .....	3480.0	3267.4	212.6	247.8	1128.6	1796.4	94.6
Feces .....	1723.6	1568.5	155.1	114.6	563.3	847.8	42.8
Amount digested .....	1756.4	1698.9	57.5	133.2	565.3	948.6	51.8
Per cent digested.....	50.5	52.0	27.0	53.7	50.1	52.8	54.8
<b>SHEEP III.</b>							
Hay .....	3480.0	3267.4	212.6	247.8	1128.6	1796.4	94.6
Feces .....	1634.3	1488.0	146.3	115.1	544.4	785.9	42.6
Amount digested .....	1845.7	1779.4	66.3	132.7	584.2	1010.5	52.0
Per cent digested .....	53.0	54.5	31.2	53.5	51.8	56.3	55.0
Average .....	53.4	55.1	27.8	53.1	53.6	56.3	56.1

## FUEL VALUES FOR FIVE DAYS.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea.	Total available fuel value.	Per cent available fuel value.
<b>FODDER: HAY.</b>						
Sheep I.....	15973	6800	9173	112	9061	56.7
Sheep II.....	15973	7889	8084	116	7968	49.9
Sheep III.....	15973	7523	8450	115	8335	52.2

## DIGESTION EXPERIMENT 82—OATS FED WITH HAY.

## RATIONS.

Fed Sheep I 400 grams oats and 400 grams hay per day.

Fed Sheep II 400 grams oats and 400 grams hay per day.

Fed Sheep III 400 grams oats and 400 grams hay per day.

Sheep I left 177 grams waste for the five days.

## COMPOSITION OF FODDERS AND FECES.

	Station number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Crude Fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDER.		%	%	%	%	%	%	%	
Hay .....	4235	87.00	93.89	6.11	7.12	32.43	51.62	2.72	4599
Oats .....	4234	86.84	96.93	3.63	13.10	11.87	65.71	5.69	4685
FECES.									
Sheep I .....	4236	.....	91.89	8.11	8.26	30.83	50.24	2.56	4681
Sheep II .....	4237	.....	92.07	7.93	7.91	31.85	50.07	2.24	4651
Sheep III .....	4238	.....	90.41	9.59	8.44	30.18	49.34	2.45	4588

## TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PER CENT DIGESTED.

	Dry matter.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.
	Grams	Grams	Grams	Grams	Grams	Grams	Grams
<b>SHEEP I.</b>							
Fed in hay.....	1582.3	1484.0	98.3	117.7	515.5	806.1	44.7
Fed in oats.....	1736.8	1673.8	63.0	227.5	206.2	1141.3	98.8
Total fed.....	3319.1	3157.8	161.3	345.2	721.7	1947.4	143.5
Total feces.....	1213.0	1114.6	98.4	100.2	374.0	609.4	31.0
Total digested.....	2106.1	2043.2	62.9	245.0	347.7	1338.0	112.5
Digested from hay.....	898.8	874.1	24.7	61.2	304.1	482.8	26.2
Digested from oats.....	1207.3	1169.1	38.2	183.8	43.6	855.2	86.3
Per cent digested from oats..	69.5	69.8	60.6	80.8	21.1	74.9	87.3
<b>SHEEP II.</b>							
Fed in hay.....	1740.0	1633.7	106.3	123.9	564.3	898.2	47.3
Fed in oats.....	1736.8	1673.8	63.0	227.5	206.2	1141.3	98.8
Total fed.....	3476.8	3307.5	169.3	351.4	770.5	2039.5	146.1
Total feces.....	1319.1	1214.5	104.6	104.3	420.1	660.5	29.6
Total digested.....	2157.7	2093.0	64.7	247.1	350.4	1379.0	116.5
Digested from hay.....	878.2	849.4	28.8	66.6	282.6	474.3	25.9
Digested from oats.....	1279.5	1243.6	35.9	180.5	67.8	904.7	90.6
Per cent digested from oats..	73.6	74.3	57.0	79.3	32.9	79.3	91.7
<b>SHEEP III.</b>							
Fed in hay.....	1740.0	1633.7	106.3	123.9	564.3	898.2	47.3
Fed in oats.....	1736.8	1673.8	63.0	227.5	206.2	1141.3	98.8
Total fed.....	3476.8	3307.5	169.3	351.4	770.5	2039.5	146.1
Total feces.....	1314.8	1188.7	126.1	111.0	396.8	648.7	32.2
Total digested.....	2162.0	2118.8	43.2	240.4	373.7	1390.8	113.9
Digested from hay.....	922.9	889.7	33.2	66.4	292.1	505.2	26.0
Digested from oats.....	1239.1	1229.1	10.0	174.0	81.6	885.6	57.9
Per cent digested from oats..	71.3	73.4	15.9	76.5	39.5	77.6	89.0
Average.....	71.5	72.5	44.5	78.9	31.2	77.3	89.3

## FUEL VALUES FOR FIVE DAYS.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea.	Total available fuel value.	Per cent available fuel value.
<b>FODDER: OATS.</b>						
Sheep I.....	8137	3179	4957	160	4797	60.0
Sheep II.....	8137	2190	5947	157	5790	71.2
Sheep III.....	8137	2270	4867	152	5715	70.2

## DIGESTION EXPERIMENT 83—ROYAL OAT FEED.

## RATIONS.

Fed Sheep I 400 grams Royal Oat Feed and 400 grams hay.

Fed Sheep II 400 grams Royal Oat Feed and 400 grams hay.

Fed Sheep III 400 grams Royal Oat Feed and 400 grams hay.

Left by Sheep I, 118 grams hay for five days.

## COMPOSITION OF FODDERS AND FECES.

	Station number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDER.		%	%	%	%	%	%	%	
Hay .....	4244	87.00	93.89	6.11	7.12	32.43	51.62	2.72	4599
Royal Oat Feed..	4245	89.63	93.61	6.39	7.46	24.98	57.73	3.44	4430
FECES.									
Sheep I .....	4246	.....	91.68	8.32	5.45	32.42	52.26	1.55	4478
Sheep II .....	4247	.....	90.87	9.13	6.09	30.84	52.20	1.74	4472
Sheep III .....	4248	.....	91.58	8.42	5.58	31.91	52.59	1.50	4480

## TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry matter.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
	Grams	Grams	Grams	Grams	Grams	Grams	Grams
<b>SHEEP I.</b>							
Fed in hay. ....	1740	1633.7	106.3	123.9	564.3	898.2	47.3
Fed in "Royal Oat Feed".....	1792.6	1678.1	114.5	133.7	447.8	1034.8	61.7
Total fed. ....	3532.6	3311.8	220.8	257.6	1012.1	1933.0	109.0
Total feces. ....	1789.1	1640.2	148.9	97.5	580.0	935.0	27.7
Total digested. ....	1743.5	1671.6	71.9	160.1	432.1	998.0	81.3
Digested from hay. ....	989.5	962.8	26.6	64.4	332.7	538.0	27.7
Digested from "Royal Oat Feed".....	754.0	708.8	45.3	95.7	99.4	460.0	53.6
Per cent digested from "Royal Oat Feed".....	42.1	42.2	39.6	71.6	20.0	48.9	86.8
<b>SHEEP II.</b>							
Fed in hay. ....	1630.2	1529.8	100.4	118.0	528.0	838.0	45.8
Fed in "Royal Oat Feed".....	1792.6	1678.1	114.5	133.7	447.8	1034.8	61.7
Total fed. ....	3422.8	3207.9	214.9	251.7	975.8	1872.8	107.5
Total feces. ....	1676.3	1523.3	153.0	102.1	517.0	875.0	29.2
Total digested. ....	1746.5	1684.6	61.9	149.6	458.8	997.8	78.3
Digested from hay. ....	822.7	795.5	27.1	63.4	264.5	442.5	25.1
Digested from "Royal Oat Feed".....	923.8	889.1	34.8	86.2	194.3	555.3	53.2
Per cent digested from "Royal Oat Feed".....	51.3	53.0	32.9	64.5	43.4	53.7	86.2
<b>SHEEP III.</b>							
Fed in hay. ....	1696.3	1592.4	103.9	121.6	549.9	874.2	46.7
Fed in "Royal Oat Feed".....	1792.6	1678.1	114.5	133.7	447.8	1034.8	61.7
Total fed. ....	3488.9	3270.5	218.4	255.3	997.7	1909.0	108.4
Total feces. ....	1710.8	1566.7	144.1	95.5	545.9	899.7	25.7
Total digested. ....	1778.1	1703.8	74.3	159.8	451.6	1009.3	82.7
Digested from hay. ....	906.8	877.5	28.9	64.6	294.7	492.2	26.2
Digested from "Royal Oat Feed".....	871.3	826.3	45.4	95.2	156.9	517.1	56.5
Per cent digested from "Royal Oat Feed".....	48.6	49.2	39.7	71.2	35.9	50.0	91.6
Average. ....	47.3	48.1	37.4	69.1	33.1	50.9	88.2

## FUEL VALUE FOR FIVE DAYS.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea.	Total available fuel value.	Per cent available fuel value.
<b>ROYAL OAT FEED.</b>						
Sheep I. ....	7941	4612	3329	83	3246	40.9
Sheep II. ....	7941	3651	4290	75	4215	53.1
Sheep III. ....	7941	3902	4039	83	3956	49.8

## DIGESTION EXPERIMENT 84—MIXED FEED.

## RATIONS.

Fed Sheep I 400 grams mixed feed and 400 grams hay.

Fed Sheep II 400 grams mixed feed and 400 grams hay.

Fed Sheep III 400 grams mixed feed and 400 grams hay.

## COMPOSITION OF FODDERS AND FECES.

	Station number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDER.		%	%	%	%	%	%	%	
Hay . . . . .	4251	87.00	93.89	6.11	7.12	32.43	51.62	2.72	4599
Mixed feed . . . . .	4250	87.64	94.27	5.73	12.98	14.56	62.11	4.62	4513
FECES.									
Sheep I . . . . .	4252	.....	90.07	9.93	9.80	30.16	48.28	1.83	4459
Sheep II . . . . .	4253	.....	90.12	9.88	9.71	30.28	48.27	1.86	4429
Sheep III . . . . .	4254	.....	89.97	10.03	9.93	28.73	49.02	2.29	4449

## TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry matter.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
	Grams	Grams	Grams	Grams	Grams	Grams	Grams
<b>SHEEP I.</b>							
Fed in hay .....	1740	1633.7	106.3	123.9	564.3	898.2	47.3
Fed in mixed feed .....	1752.8	1652.4	100.4	227.5	255.2	1088.7	81.0
Total fed .....	3492.8	3286.1	206.7	351.4	819.5	1986.9	128.3
Total feces .....	1468.2	1322.4	145.8	143.9	442.6	708.9	26.9
Total digested .....	2024.6	1964.7	60.9	207.5	376.9	1278.0	101.4
Digested from hay .....	989.5	962.8	26.6	64.4	332.7	538.0	27.7
Digested from mixed feed ...	1035.1	1001.9	34.3	143.1	44.2	740.0	73.7
Per cent digested from mixed feed .....	59.1	60.6	34.2	62.9	17.3	68.0	91.0
<b>SHEEP II.</b>							
Fed in hay .....	1740	1633.7	106.3	123.9	564.3	898.2	47.3
Fed in mixed feed .....	1752.8	1652.4	100.4	227.5	255.2	1088.7	81.0
Total fed .....	3492.8	3286.1	206.7	351.4	819.5	1986.9	128.3
Total feces .....	1468.9	1323.8	145.1	142.6	444.8	709.1	27.3
Total amount digested .....	2023.9	1962.3	61.6	208.8	374.7	1277.8	101.0
Digested from hay .....	878.2	849.4	28.8	66.6	282.6	474.3	25.9
Digested from mixed feed ...	1145.7	1112.9	32.8	142.2	92.1	803.5	75.1
Per cent digested from mixed feed .....	65.4	67.4	32.7	62.5	36.1	73.8	92.7
<b>SHEEP III.</b>							
Fed in hay .....	1740	1633.7	106.3	123.9	564.3	898.2	47.3
Fed in mixed feed .....	1752.8	1652.4	100.4	227.5	255.2	1088.7	81.0
Total fed .....	3492.8	3286.1	206.7	351.4	819.5	1986.9	128.3
Total feces .....	1476.0	1330.2	145.8	143.3	446.9	712.5	27.5
Total digested .....	2016.8	1955.9	60.9	208.1	372.6	1274.4	100.8
Digested from hay .....	922.9	889.7	33.2	66.4	292.1	505.2	26.0
Digested from mixed feed ...	1093.9	1066.2	27.7	141.7	80.5	769.2	74.8
Per cent digested from mixed feed .....	62.4	64.5	27.6	62.3	31.5	70.7	92.4
Average .....	62.3	64.2	31.5	62.6	28.3	70.8	92.0

## FUEL VALUE FOR FIVE DAYS.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea.	Total available fuel value.	Per cent available fuel value.
<b>MIXED FEED.</b>						
Sheep I .....	7909	2497	5412	125	5287	66.8
Sheep II .....	7909	1918	5991	124	5867	74.2
Sheep III .....	7909	2165	5753	123	5640	71.3

## DIGESTION EXPERIMENT 85—CORN GERM.

## RATIONS.

Fed Sheep I 300 grams corn germ, 400 grams hay per day.

Fed Sheep II 300 grams corn germ, 400 grams hay per day.

Fed Sheep III 300 grams corn germ, 400 grams hay per day.

## COMPOSITION OF FODDERS AND FECES.

	Station number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDER.		%	%	%	%	%	%	%	
Hay .....	4235	87.00	93.89	6.11	7.12	32.43	51.62	2.72	4599
Corn Germ .....	4227	90.42	96.05	3.95	25.37	23.72	35.68	11.28	5110
FECES.									
Sheep I .....	4255	.....	90.06	9.94	12.57	30.70	44.59	2.20	4527
Sheep II .....	4256	.....	91.05	8.95	12.66	30.34	45.64	2.41	4603
Sheep III .....	4257	.....	89.65	10.31	14.53	29.30	43.55	2.31	4520

## TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry matter.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.
	Grams	Grams	Grams	Grams	Grams	Grams	Grams
SHEEP I.							
Fed in hay.....	1740.0	1633.7	106.3	123.9	564.3	898.2	47.3
Fed in corn germ.....	1456.3	1398.8	57.5	369.2	345.4	519.7	164.4
Total fed.....	3196.3	3032.5	163.8	493.1	909.7	1417.9	211.7
Total feces.....	1135.2	1022.3	113.0	142.7	348.4	506.1	25.0
Total digested.....	2061.1	2010.2	50.8	350.4	561.3	911.8	186.7
Digested from hay.....	989.5	962.8	26.6	64.4	332.7	538.0	27.7
Digested from corn germ....	1071.6	1047.4	24.2	286.0	228.6	373.8	159.0
Per cent digested from corn germ.....	73.6	74.9	42.1	77.5	66.2	71.9	96.7
SHEEP II.							
Fed in hay.....	1740.0	1633.7	106.3	123.9	564.3	898.2	47.3
Fed in corn germ.....	1456.3	1398.8	57.5	369.2	345.4	519.7	164.4
Total fed.....	3196.3	3032.5	163.8	493.1	909.7	1417.9	211.7
Total feces.....	1151.5	1048.4	103.1	145.8	349.4	525.6	27.8
Total digested.....	2044.8	1984.1	63.7	347.3	560.3	892.3	183.9
Digested from hay.....	989.5	962.8	26.6	64.4	332.7	538.0	27.7
Digested from corn germ....	1055.3	1021.3	37.1	282.9	227.6	354.3	156.2
Per cent digested from corn germ.....	72.5	73.0	64.5	76.6	65.9	68.2	95.0
SHEEP III.							
Fed in hay.....	1740.0	1633.7	106.3	123.9	564.3	898.2	47.3
Fed in corn germ.....	1456.3	1398.8	57.5	369.2	345.4	519.7	164.4
Total fed.....	3196.3	3032.5	163.8	493.1	909.7	1417.9	211.7
Total feces.....	1116.2	1001.1	115.1	162.2	327.1	486.1	25.7
Total digested.....	2080.1	2031.4	48.7	330.9	582.6	931.8	186.0
Digested from hay.....	989.5	962.8	26.6	64.4	332.7	538.0	27.7
Digested from corn germ....	1090.6	1068.6	22.1	266.5	249.9	393.8	158.3
Per cent digested from corn germ.....	74.9	76.4	38.4	72.2	72.4	75.8	96.4
Average.....	73.7	74.8	48.3	75.4	68.2	71.9	96.0

## FUEL VALUE FOR FIVE DAYS.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea.	Total available fuel value.	Per cent available fuel value.
FODDER: CORN GERM.						
Sheep I.....	7442	1739	5703	249	5454	73.3
Sheep II.....	7442	1356	6086	246	5840	78.5
Sheep III.....	7442	1282	6159	232	5927	79.6

## SUMMARY OF DIGESTION COEFFICIENTS OBTAINED IN THE EXPERIMENTS HERE REPORTED.

	Number of experiment.	Dry matter.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.
	%	%	%	%	%	%	%	%
Clover hay, cut in early bloom .....	70	57.6	59.0	44.6	65.9	51.8	62.9	27.9
Clover hay, cut in late bloom. ....	71	55.6	57.2	38.5	67.3	43.6	64.3	35.4
Clover silage made from clover cut in late bloom. ....	72	52.3	53.3	44.0	39.7	55.2	55.8	54.1
Corn meal.....	73	88.5	89.0	68.7	72.9	.....	91.7	80.6
Hay, mostly timothy .....	74	57.6	57.9	53.5	65.2	48.0	63.0	44.6
Oats .....	75	69.2	71.3	.....	75.5	30.8	77.2	.....
Pea and oat hay .....	76	64.2	62.5	58.2	72.2	63.0	63.7	54.4
Oat and pea silage .....	77	65.5	66.6	52.4	74.6	61.3	67.0	75.0
Oat and vetch hay .....	78	55.4	56.2	44.3	65.3	49.0	59.0	62.8
Oat and vetch hay .....	79	60.1	60.2	60.2	69.5	51.5	62.7	73.8
Oat and pea hay.....	80	58.5	58.5	59.1	74.7	51.8	57.6	64.8
Hay, mostly timothy .....	81	53.4	55.1	27.8	53.1	53.6	56.3	56.1
Oats .....	82	71.5	72.5	44.5	78.9	31.2	77.3	89.3
Royal oat feed.....	83	47.3	48.1	37.4	69.1	33.1	50.9	88.2
Mixed feed .....	84	62.3	64.2	31.5	62.6	28.3	70.8	92.0
Corn germ .....	85	73.7	74.8	48.3	75.4	68.2	71.9	96.0

## A COMPARISON OF DETERMINED AND CALCULATED HEATS OF COMBUSTION.

L. H. MERRILL.

It has been frequently observed in this laboratory and elsewhere that the heats of combustion of vegetable foods as determined are higher than the results obtained by calculation when the usual factors are employed. This fact is illustrated by the wheat products in the following table in which it will be seen that the differences range from .026 to .430 calories, or from nearly one to ten percent of the determined value. The wheat products were chosen because they contain nutrients of precisely the same character and origin, but in varying proportions. The milling products are placed in the table below the wheats from which they were derived. The calculated results are obtained by the use of Rubner's factors, viz.: for 1 gram protein, 5.5 calories; for fat, 9.3 calories; for carbohydrates, 4.1 calories.

HEATS OF COMBUSTION OF WHEATS AND THEIR MILLING PRODUCTS  
DETERMINED COMPARED WITH THE CALCULATED VALUES.

Laboratory number.	Material.	HEATS OF COMBUSTION.			Crude fiber.
		Determined.	Calculated.	Difference.	
		Calories	Calories.	Calories.	%
6301	Wheat .....	3.918	3.849	.069	2.00
6302	Flour, first grade.....	3.839	3.813	.026	.23
6303	Flour, second grade... ..	3.892	3.843	.049	.29
6304	Middlings.....	4.169	4.023	.146	4.80
6305	Bran .. ..	4.163	3.933	.430	7.32
....	Wheat .....	3.922	3.833	.089	2.54
6296	Flour, first grade .....	3.768	3.679	.089	.16
6297	Flour, second grade.....	3.780	3.701	.079	.27
6299	Middlings .....	4.115	4.605	.110	3.20
6298	Bran .....	4.142	3.946	.196	7.18
6270	Wheat .....	3.987	3.892	.095	1.96
6273	Flour, high grade .....	3.942	3.864	.078	.33
6279	Flour, low grade .....	4.365	4.218	.147	2.47
6280	Middlings .....	4.350	4.075	.275	9.62
6281	Bran .....	4.196	3.900	.296	10.07

A very brief inspection of the table will show that the differences noted stand in very intimate relation to the amount of crude fiber present, and leads to a suspicion that the fiber is the

disturbing element. If this be true we should expect to find the greatest difference between the determined and calculated heats of combustion in those materials which are especially rich in fiber, such as the coarse fodders and feces of herbivorous animals. The following results of feeding experiments with sheep serve to illustrate this.

Laboratory number.	Fodders and Feces.	Crude fiber.	HEATS OF COMBUSTION.		
			Determined.	Calculated.	Difference.
		%	Calories.	Calories.	Calories.
4130	Oat hay .....	30.74	4.209	3.719	.490
4131	Sheep feces from oat hay.....	33.65	4.290	3.682	.608
4160	Clover silage .....	33.43	4.184	3.638	.546
4161	Sheep feces from clover silage.....	32.16	4.379	3.805	.574
4202	Oat and pea silage .....	31.12	4.209	3.984	.225
4204	Sheep feces from oat and pea silage ...	32.88	4.163	3.669	.494

The results given in the last column are not, however, proportional to the amount of crude fiber present, but are much greater in the feces. This suggested a study of the fiber itself. A quantity was prepared from both fodders and feces and burned in the usual manner. The results, reduced to a water- and ash-free basis are given here.

#### HEATS OF COMBUSTION OF CRUDE FIBER FROM FODDERS AND THEIR FECES CORRESPONDING.

Lab. No.	Source of crude fiber.	Heats of combustion.	Lab. No.	Source of crude fiber.	Heats of combustion.
4130	Oat hay.....	4.405	4131	Feces from oat hay ..	4.662
4160	Clover silage.....	4.610	4161	Feces from clover silage .....	5.215
4202	Oat and pea silage ...	4.667	4204	Feces from oat and pea silage.....	4.820
	Average.....	4.561		Average. ....	4.899

The crude fiber from the feces had, in these three cases, an average determined fuel value over 7 per cent higher than that of the fiber from the corresponding fodders. In other words, the digestible crude fiber had a lower fuel value than that remaining in the feces, and consequently, lower than that of the mixture of carbohydrates included in that term as found in the original fodders.

## EXPERIMENTS WITH INSECTICIDES UPON POTATOES.

CHAS. D. WOODS.

Through the generous coöperation of Mr. John Watson of Houlton the Station has been able to make under exceedingly favorable conditions field experiments upon the potato. Not only did Mr. Watson give the free use of land, but he also furnished the labor and machinery. The management of the Bangor and Aroostook Railroad, with their characteristic interest in and support of all that has for its aim the improvement and development of Aroostook county, furnished free passenger transportation to a large amount. Because of this help the Station was enabled to make a series of experiments which it could not otherwise have undertaken.

Experiments as follows have been carried to a successful issue:

1. A soil test experiment of 25 plots.
2. An experiment of 25 plots on the effect of fertilizers, particularly different potash salts, upon the starch content of the potato.
3. A spraying experiment with Bordeaux mixture and other fungicides for potato blight.
4. An experiment with several commercial insecticides in comparison with Paris green as a remedy for the potato beetle.

The experiments with insecticides are here reported. The others will be prepared for publication as early as practicable.

For the experiment with insecticides, Mr. Watson kindly placed a ten acre field of fairly uniform slope and soil at our disposal.

This field was planted with Green Mountain potatoes late in April, the rows running east and west. There were 224 rows about 30 rods long running across the field, and in addition about 20 shorter rows at the north and ten at the south ends of the

field. The piece was divided in this way into 14 plots of 16 rows each with 2 plots of shorter rows at either end. The short rows were untreated except that Paris green and whitewash were sprayed on these July 27th so as to kill most of the bugs. The arrangement of the plots and their treatment is shown in the following plan:

## ARRANGEMENT OF PLOTS.

Each plot consisted of 16 rows about 30 rods long. The rows ran east and west. Row 1 at north end.

No. of rows.	Kinds of Insecticides.	Rate per acre at each application.
		Pounds.
1 to 17 .....	Paris green .....	$\frac{1}{2}$
17 to 32 ....	Boxal (arsenate of lead as the poison) .....	5
33 to 48 ....	Boxal (arsenate of lead as the poison) .....	10
49 to 64 ....	Paris green .....	$\frac{1}{2}$
65 to 80 ....	Paragrene .....	$\frac{1}{2}$
81 to 96 ....	Paris green .....	$\frac{1}{2}$
97 to 112 ...	Swift's arsenate of lead .....	1
113 to 128 ..	Arsenoid No. 2 .....	$\frac{1}{2}$
129 to 144 ..	Paris green .....	$\frac{1}{2}$
145 to 160 ..	Arsenoid No. 3 .....	$\frac{1}{2}$
161 to 176 ..	Paris green .....	$\frac{1}{2}$
177 to 192 ..	Arsenoid No. 4 .....	$\frac{1}{2}$
193 to 208 ..	Arsenoid No. 5 .....	$\frac{1}{2}$
209 to 224 ..	Paris green .....	$\frac{1}{2}$

## DATES OF APPLICATION.

The insecticides were applied under the immediate oversight of the writer, with water together with a fungicide, either Bordeaux mixture, or other similar materials, in the form of a fine spray at the following dates:

July 11, rows 1 to 128; July 13, rows 129 to 224; July 21, rows 1 to 224; July 27, rows 1 to 224; August 10, rows 1 to 112, and August 11, rows 113 to 224.

The experiment was visited by the writer at least once a week during the growing season, and two or three days after each application each plot was carefully examined and full notes taken.

## THE APPLICATION OF PARIS GREEN AND OTHER POWDERED INSECTICIDES.

When Paris green was first used for the potato beetle it seems to have been applied dry. This was probably partly due to the difficulty of transporting the water and partly (and perhaps more especially) to the imperfect distribution which resulted from sprinkling the plants with watering cans. Since the introduction of improved spraying machinery, the poisons can be more evenly and effectively distributed with water than by dusting.

None of the poisonous powders are dissolved in the water but are mixed with it and held suspended. The heavier the powder and the coarser the particles the greater will be the tendency for it to settle in it. An efficient agitator is an indispensable part of a spraying outfit. The materials are best applied as a fine spray, as in this way the whole plant can be readily covered and practically none of the solution runs off the foliage. In the case of the copper compounds of arsenic, freshly slacked lime should be added to the water at the rate of 2 pounds to barrel.\* This will make the Paris green, etc., adhere better and effectually prevent burning the foliage. Half a pound of good, finely pulverized Paris green can be sprayed on so as to be more effective than a much larger amount applied with a "gun" or other dusting devices. It can also be applied much faster and with less labor. One man with a 4-rowed mechanical sprayer can readily treat 20 acres a day, and 30 acres with a 6-rowed sprayer.

In the experiments here reported upon, the poisons were all applied with a four-rowed mechanical sprayer fitted with a powerful hand pump. As it was desired to take every precaution for thorough spraying, two men were on the cart, one to pump, the other to drive and watch that the nozzles did not get stopped. In the first spraying one Vermorel nozzle was over each row and the rows were gone over twice in opposite directions. The other three applications were made with a double Vermorel nozzle. A barrel of spraying materials with two single or one double nozzle for each row will spray an acre. Some power mechanical sprayers, such as the Aspinwall, do not have

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\*In case the plants are sprayed with Bordeaux mixture at the same time, the addition of the lime is not necessary.

a sufficiently powerful pump to use double nozzles, and on this account are not well adapted to practical spraying in a potato growing district.

#### RESULTS WITH INSECTICIDES.

While experiments at this time included only Paris green, arsenate of lead, Paragrene and the arsenoids, notes are here given on other insecticides which are used to a greater or less extent in the State.

#### PARIS GREEN.

Since the advent of the Colorado potato beetle, Paris green has been the favorite and indeed practically the only insecticide used. According to the U. S. Dispensatory, Paris green is the aceto-arsenite of copper and "is made by mixing 5 parts of verdigris with sufficient water to form a thin paste, and adding to this a boiling solution of 4 parts of arsenious acid in 50 parts of water, keeping the mixture at the boiling temperature and adding a little acetic acid to cause it to retain a brilliant color." The pure aceto-arsenite of copper should carry 58.65 per cent of arsenious oxide. There is also another compound sometimes sold under the name of Paris green which is practically the arsenite of copper and theoretically carries 52.94 per cent of arsenious oxide. (See arsenoids beyond.)

Formerly Paris green was used only as a pigment and the first aim of the manufacturer was to produce a good bright green. Since its use as an insecticide the consumption has greatly increased and different manufacturers have modified the process of manufacture so that in many instances they differ quite widely from that outlined above. In at least one plant the green is made from copper oxide, arsenious acid, and a soluble acetate. The ingredients used will always contain varying amounts of impurities and on this account very little, if any, Paris green is strictly pure aceto-arsenite of copper. As the arsenious acid is the cheapest single constituent, the claim made by one manufacturer that "as long as the green is pure, the manufacturer will endeavor to get as much arsenic into it as possible, consistent with making a good bright green," is probably true. So-called "pure" Paris greens which do not bear evidence of adulteration have been found to carry as little as 47 per cent of arsenious acid and others

have carried as high as 68 per cent. In the case of the goods with the low percentage, the relatively small amount of arsenic is due to impurities of the materials. In the case of green carrying more than 58.7 per cent of arsenious acid, the higher arsenic content can only be explained by their having an excess of uncombined arsenious acid (white arsenic). As white arsenic burns foliage much more than does Paris green, or even London purple, its presence in Paris green is objectionable. The purity of a Paris green is not necessarily indicated by its arsenic content since an excess of uncombined white arsenic is nearly as dangerous an adulterant as the presence of inert foreign matter. When pure, Paris green should have at least 50 per cent of arsenious oxide and should be practically free from uncombined arsenic. Important as the purity of the green is, its mechanical condition is of great moment. To thoroughly protect the plant it is necessary that the poison be thoroughly distributed. It follows therefore that of two equally pure greens, the one that is in the finer powder will prove the more effective. In our experience there is greater danger of purchasing imperfectly pulverized, than adulterated Paris green.

The purity of Paris green can be quite readily and fairly accurately tested by dissolving the Paris green in strong ammonia water. If pure all of the Paris green will dissolve, the solution turning a deep blue color. Undissolved sediment indicates impurities or adulteration. Another test is to place a little of the Paris green between two pieces of window glass and rub them together. If the Paris green is adulterated with lime, barium sulphate, or similar white materials, the Paris green will appear to turn white in places. Paris green of good quality is intensely bright green and uniform. When adulterated, the green loses something of its intensity and is grayish green and is not always uniform.

In the experiments here reported upon, Paris green was used in connection with some form of Bordeaux mixture in all of the check plots.

The Paris green was applied at the rate of one-half pound to the acre. The first application was made before any of the eggs had hatched and may have been unnecessary. The three applications of Paris green at the rate of one-half pound to the acre

kept the bugs so reduced in numbers that they did no appreciable damage to the vines, and the fourth application (August 10-11) was unnecessary. The green was as usual somewhat difficult to keep thoroughly and evenly suspended in the water. When applied with lime at the rate of  $\frac{1}{2}$  pound of Paris green and two pounds of lime to the acre, the Paris green was more effective than when applied at the same rate with copper, (Bordeaux mixture). The copper appeared to be distasteful to the bugs and they would leave the thoroughly sprayed leaves for those that had less copper and in this way they avoided the leaves with the most Paris green. If vines are sprayed before the bugs have made much growth, there is no difficulty in keeping them in check, so they can do no harm, with two or three applications of Paris green at the rate of  $\frac{1}{2}$  pound to the acre. Applied at this rate with Bordeaux mixture or lime, there is no danger of burning the foliage.

#### LONDON PURPLE.

London purple was first introduced in this country as an insecticide in 1877. It is a waste product in the manufacture of some dye stuffs and consists largely of arsenic, lime and the dye. It is cheaper than Paris green, contains more arsenic and can be more easily applied.

Its composition is not so uniform, and it is more apt to injure foliage so that on the whole Paris green has been preferred. It was not used in the experiments here reported upon. Paris purple and English purple are two preparations quite similar in character to London purple. When any of the purples are used as insecticides they should be used with two or three times their weight of lime because of the soluble arsenic which they contain.

#### PARAGRENE.

Paragrene is a patented article which claims to be free from many of the objectionable features of Paris green. The manufacturers state that "Paragrene is a definite compound of arsenic, sulphate of copper and lime and is made in such a way as to neutralize whatever effect the acids, necessary to prepare the ingredients, would have on plant life." It has recently been analyzed by the California Agricultural Experiment Station and found to contain 23.46 per cent of copper oxide and 40.60

per cent of arsenious oxide, 23.08 per cent of which is free. It also contains 19.31 per cent of gypsum to add weight. Because of its large amount of free arsenious oxide it would be apt to burn the foliage of tender plants. On such a plant as the potato and in the small quantity used mixed with lime or Bordeaux mixture, the burning by this amount of free arsenic would not be likely to be great. It was applied four time with Bordeaux mixture at the rate of one-half pound per acre to rows 65 to 80. The field notes follow.

July 11, potatoes just beginning to bloom, no slugs hatched yet, sprayed; July 21, sprayed; July 24, very few bugs, none on coated or eaten leaves; July 27, sprayed; August 1, practically no bugs; August 8, practically no bugs; August 10, sprayed; August 14, no bugs; August 23, a few leaves are browned and curled on *edges*; no spots as in blight; appear to be slightly burned; September 4, the "burning" has made no progress.

The Paragrene used in this experiment was coarser than Paris green and when wet up with water there was quite a little residue left that would not go through a fine Vermorel nozzle. The attention of the company was called to the coarseness of the sample we used and in explanation they write as follows: "This is no doubt due to the rent or tear in the mill in which it is bolted. Sometimes this is bound to occur and a lot will go through the bolter before it is discovered, but we can assure you it is only an accident and instead of being coarse and gritty, the goods are always as fine as it is possible to get the best grade of flour."

In this experiment Paragrene proved as effective as Paris green and in the amount used did not burn the foliage so as to injure it, if at all.

#### ARSENOIDS.

Under the general name arsenoids quite a number of different arsenites have been placed upon the market. White arsenoid was supposed to be barium arsenite, but all of its arsenious acid was free so that it was no better than white arsenic diluted with baryta. Pink arsenoid is arsenite (not arsenate) of lead. A sample examined by the California Station\* carried 40 per cent of combined and  $3\frac{1}{4}$  per cent of free arsenious acid. The green

\* Bulletin No. 126.

arsenoid or arsenite of copper has been quite extensively introduced by the Adler Color and Chemical Works. A sample examined by the California Station was found to carry  $53\frac{1}{2}$  per cent of combined and nearly 8 per cent of free arsenious oxide. As previously stated, copper arsenite if pure would carry about 53 per cent of combined arsenious oxide.

The Adler Color and Chemical Works are experimenting with different arsenoids with the hope of obtaining compounds which will be as effective and at the same time cheaper than Paris green. Four of these materials called Arsenoids Nos. 2, 3, 4, and 5 were used in these experiments. In each case they were applied four times with Bordeaux mixture at the rate of one-half pound of arsenoid to the acre.

The manufacturers make the following statements to us relative to these materials.

"No. 2 arsenoid is a compound containing arsenious acid, copper and lime and is made by treating arsenite of soda with sulphate of copper and lime. This gives an absolutely neutral combination of salts which is not likely to do any damage to foliage even when used in very strong solution. Could be sold for about 8 cents per pound. We have hopes that this will prove in every respect a most desirable insecticide.

"No. 3 arsenoid is made by treating a solution of acetate of lead with arsenate of soda and at the same time making an admixture of arsenite of copper. Cost of this would be about 14 cents per pound.

"No. 4 arsenoid is made by precipitating acetate of lead with arsenate of soda and at the same time adding arsenite of soda precipitated with lime, along with an admixture of arsenite of copper. The resulting compound consists of arsenite of lead, arsenite of lime and some arsenite of copper. This could be sold for about 10 cents per pound.

"No. 5 arsenoid is made by precipitating arsenite of soda with sulphate of copper and lime, producing an arsenite of copper and lime. This could be sold for about 10 cents per pound."

There was not much difference to be seen in the way the different arsenoids acted. None of them at the rate used burned the foliage and they all killed the bugs practically as well as Paris green. The arsenoids are more bulky and on this account are

more readily kept in suspension than Paris green. The field notes show the arsenoids to have been about as effective as Paris green but not so effective as the arsenate of lead. While they may contain more free (uncombined) arsenious acid than the best made Paris greens, they probably contain no more than the average Paris green. There is little reason for using them instead of Paris green unless they can be had at a considerable lower price.

#### ARSENATE OF LEAD.

The Massachusetts Gypsy Moth Commission have during the past ten years made exhaustive comparative studies of different arsenical compounds as insecticides. In 1893 Mr. F. C. Moulton, a graduate of the Chemical Course of the University of Maine, was employed by the commission and suggested the use of arsenate of lead as an insecticide. It was found to be "the most effective poison yet used" and for the last year or two of the commission it was employed almost exclusively. The findings of the commission are summarized as follows:\*

"Although nearly all poisons known to us which can be used as insecticides have been experimented with during the past five years in the hope that something would be found which would prove fatal to the gypsy moth, only one which is more effective than Paris green has been discovered. This is arsenate of lead, a poison slower in its action than the other, but which has three distinct advantages: (1) It can be used at any desired strength without serious injury to the foliage; (2) It is visible wherever used, as it forms a whitish coating on the leaves; (3) It has adhesive qualities, given it, probably, by the acetate of lead, and therefore remains on the leaves for a much longer period than Paris green. When sufficient glucose was added to a strong mixture of arsenate of lead, it withstood rainstorms and remained on the foliage during an entire season."

The arsenate of lead used by the commission was prepared, for the most part, by using 30 parts of arsenate of soda and 70 parts of acetate of lead. Prof. C. H. Fernald directs that arsenate of lead can be prepared in the proportions of 11 ounces of acetate of lead, and four ounces of arsenate of soda. The materials are

\*The Gypsy Moth, Forbush and Fernald published by the Massachusetts Board of Agriculture, pages 141 and 142.

dissolved separately in water and slowly poured together with stirring.

Arsenate of lead is made by William H. Swift & Company, Boston, Mass., and the Bowker Chemical Company also of Boston. The latter company sell the goods under the name of Disparene. The chemist of one of the companies was for several years with the Gypsy Moth Commission and while with them constantly urged farmers to make arsenate of lead by the above formula and use it as an insecticide. Because of this we asked him why he now recommends the consumer to buy the "ready made" instead of using "home made" arsenate of lead. His reply (in part) is as follows:

"Between the years 1896 and 1899 Prof. C. H. Fernald and I, as opportunity offered, preached faithfully the gospel of home made arsenate of lead to our fruit growers and farmers. We had to do this. There was no one making it. As a result of these continued efforts not more than 15 or 20 farmers tried it. Most of them found it too expensive; many of them injured their foliage because of poor chemicals, wrong formula or improper mixing.

"The objections to the use of the home made article are the difficulties attending its manufacture. The more important are:

"To obtain arsenate of soda free from adulteration. In our experience in the gypsy moth work we were greatly bothered with adulterated arsenate of soda. Made as it generally is, by the use of rock salt, there is more or less of the latter left in the arsenate of soda. When mixed with a solution of lead salts, the sodium chloride acts first, forming lead chloride, which has no value as an insecticide; later, the arsenate of soda reacts, but often there is not lead enough allowed for the complete neutralizing of the latter. This leaves soluble arsenic in the mixture and "burned" foliage results. We went over the ground fully in our gypsy moth work and finally had to import arsenate of soda from England in order to get a pure article.

"The establishing a correct formula. Commercial arsenates of soda vary from 50 per cent to 98 per cent in purity. The ordinary formula, 11 ounces sugar of lead to 4 ounces arsenate of soda applies to the 50 per cent article. For the 65 per cent, less arsenate of lead must be taken; for the 98 per cent, still less.

The farmer must know the grade of goods he is working with and establish a new formula with each change of percentage."

The experience of the other company is practically the same. In answer to the question why ready made was superior to home made arsenate of lead, they said (in part) as follows:

"In regard to your inquiries regarding the manufacture of arsenate of lead, would say that it is made from arsenate of soda with either acetate or nitrate of lead. Each salt is dissolved separately, filtered and the solutions added together, when arsenate of lead precipitates out chemically. It is very necessary to have exactly the right proportions of the two salts, as an excess of either (particularly the arsenate of soda) will burn the foliage. As commercial arsenate of soda runs from 50 per cent to 68 per cent arsenious acid and acetate of lead varies somewhat, the correct proportions cannot be obtained without a chemical analysis.

"The remarkable adhesiveness of arsenate of lead is principally due to the extreme fineness of the particles in the precipitate. This we have been able to obtain only by a great many experiments to find the right conditions.

"Both arsenate of soda and acetate of lead are deadly poisons, and would be much more dangerous to have around than a disinfectant plainly marked, and understood to be poisonous.

"Taking all these facts into consideration, in our opinion the making and use of arsenate of lead by persons without a chemical knowledge would be dangerous and unsatisfactory."

While both of these companies have made the difficulties of preparation fully as great as they really are, there is no doubt that the average man had far better buy prepared arsenate of lead than attempt its manufacture.

As sold, arsenate of lead (including disparene) is put up in paste form, and carries from 60 to 70 per cent of arsenate of lead.

In the experiments here reported upon Swift's arsenate of lead and Bowker's boxal (in which the poison is lead arsenate) were used. Disparene was sent, but it was received too late to be used for the first spraying.

*Swift's arsenate of lead.* Rows 97 to 112 were treated four times with Bordeaux mixture and Swift's arsenate of lead at the rate of one pound to the acre. The field notes are as follows:

July 11, potatoes beginning to bloom, no slugs hatched yet, sprayed; July 21, sprayed; July 24, practically no bugs, less than on any other plants; July 27, sprayed; August 1, with the exception of three hills the north side of which was missed in spraying, only two bugs were seen in the whole length (30 rods) of 4 rows; August 8, practically free from bugs; August 10, sprayed, it began to sprinkle as this was being applied, only a light shower, but did not clear off; August 14, no bugs.

*Boxal as an Insecticide.* Boxal is a "concentrated Bordeaux mixture, reenforced with copper hydrate for the prevention of blight and sufficient arsenic for killing leaf-eating insects." The arsenic is in the form of arsenate of lead. It was applied in these experiments four times at the rate of 5 pounds, and in another plot at the rate of 10 pounds of boxal to the acre. The field notes are as follows:

Rows 17-32, boxal at the rate of five pounds to the acre. July 11, potatoes just beginning to bloom, no slugs hatched yet, sprayed; July 21, sprayed; July 24, bugs more numerous than on rows 1-16 (Paris green) but no badly eaten plants; July 27, sprayed; August 1, bugs less than on rows 1-16 (sprayed with Paris green); August 8, a few bugs, about the same as on rows 1 to 16; August 10, sprayed; August 14, very few bugs,—none except on here and there a plant.

Rows 33 to 48. Boxal at the rate of 10 pounds to the acre. July 11, potatoes just beginning to bloom, no slugs hatched yet, sprayed; July 21, sprayed; July 24, bugs about the same as on rows 1 to 16, no living bugs on eaten leaves; July 27, sprayed; August 1, very few bugs and then only on occasional hills, no need of further spraying for bugs; August 8, practically no bugs; August 10, sprayed; August 14, no bugs.

In this experiment spraying four times with boxal at the rate of five pounds to the acre and three times at the rate of ten pounds to the acre kept the bugs from doing any damage. The larger application was the more effective.

*Disparene.* Disparene is a paste of arsenate of lead and "contains from 62 to 68 per cent of arsenate of lead." As previously stated it was received too late to be used in the experiment. It was however applied to a piece of 3 or 4 acres which had been sprayed twice with Paris green without killing off the bugs as

much as was desirable. The spraying with disparene was effective and cleared the field from bugs.

Disparene was used by several farmers in the vicinity of Houlton and, in some instances, the results were not satisfactory. From our experience with arsenate of lead the trouble would seem to be in the application rather than in the poison itself.

#### SUMMARY.

Arsenate of lead was used at the rate of one pound to the acre and in the case of boxal much less than that. It is very readily mixed with water and stays in suspension so that it is possible to apply it much more evenly than Paris green. It adheres well to the foliage and is the most effective of any of the insecticides tried.

#### BUG DEATH.

The Danforth Chemical Company of Leominster, Mass., have put upon the market a preparation for which they make great claims and for whose merits some users fail to find language too strong in which to extol the goods. The advertising circular of 1900 says:

"The farmers who used Bug Death freely the past season on potatoes had a large crop of good smooth potatoes that actually brought a higher price in the market than those of their brother farmers who did not use Bug Death, but who did use some of the many insecticides that contain arsenic.

"Why should you feed your crops on a deadly poison? Is it not better to feed them with something that is a plant food, as well as an insecticide, thus freeing the plant of the insects and promoting growth, which increases yield and improves quality, especially when blight is prevalent? If used according to directions the extra yield will more than pay the entire expense.

"If you have made a test of it we rest assured that you will be a permanent customer. If to you it is new or unheard of we ask that you read these testimonials which, coming as they do from prominent dealers (all of whom are well and favorably known to the people of their respective states), will, we are sure, induce you to at least give Bug Death a trial, and then we are confident that the practical results derived from its use will convince you of its merits."

Following this are a large number of testimonials from dealers and others of the wonderful results which followed the use of Bug Death in 1899.

This Station has not made an analysis of Bug Death but it was analyzed by the N. Y. (Cornell) Station in 1898 and found to consist of zinc oxide 76.5 per cent, lead oxide 9.8 per cent, iron oxide 7.8 per cent, small amounts of silica, chlorine, potash and a trace of phosphoric acid.

In May we wrote the Danforth Manufacturing Company, as we did all other manufacturers whose goods we proposed testing in the field and received a letter from the superintendent saying: "We are desirous of having our good tested this year." He stated that he was to be in Maine in the near future and that he would call and talk the matter over. The latter part of June he called at the Station. The interview was a pleasant one and while we expressed doubts as to the goods doing what was claimed for them, the whole experiment was explained to the superintendent and he went away saying that personally he would like to have the trial made but that he would have to consult with his associates. Under date of June 26th he wrote as follows: "The writer has conversed with other members of our firm in regard to entering the competition test at Houlton, and we have decided not to go into it this year."

After the spraying experiment was well under way we learned more as to the large sales of Bug Death that were being made in Maine and decided to give the goods a trial. Near the large experimental field was a small plot (about  $\frac{1}{4}$  of an acre) used by the former owner of the place as a garden which was planted to Green Mountain potatoes. About half of it was treated with Black Death and later with Paris green and the remainder with Bug Death.

The directions for application of Bug Death are as follows:

"For potato and other plants or vines which require a top application, apply dry with Perfection shaker at the rate of  $12\frac{1}{2}$  pounds or more per acre to an application, according to size and condition of the vines. Dust the plants thoroughly and pleasing results will follow."

## THE FIELD NOTES ARE AS FOLLOWS:

July 23, five pounds of Bug Death (at the rate of 40 pounds per acre) applied. Bugs in all stages of growth, but not very numerous.

July 24, bugs not very numerous but apparently happy. Many feeding on eaten plants and no signs of disturbance and no dead ones on the ground. Diligent search failed to show a single dead beetle or slug or a badly eaten plant cleared. Five pounds more (a total of 80 pounds per acre) applied.

July 25, heavy rain.

July 27, bugs numerous. Decided to give up use of Bug Death but the superintendent of the Danforth Chemical Company arrived before the plot was treated with Paris green, and at his desire the piece was treated with one package (12½ pounds) or at the rate of 100 pounds per acre. This was applied with the Perfection shaker and it took one man a little less than an hour and a half to apply it.

August 1, bugs practically all gone. No dead ones to be seen. A few leaves that look as though they had been burned. There was a heavy shower last night and the Bug Death appears to be practically all washed off.

August 7, practically no bugs.

August 14, some bugs but less than on the part treated (one application, July 27) with Paris green. The edges of some leaves, especially at east end, are brown. It does not look like blight but more as if they had been burned.

August 18, blight beginning to appear but considerably less than on other part of piece. Burned leaves are more conspicuous than on the 14th.

August 23, burned leaves still more conspicuous, chiefly at east end. Some bugs and blight but not nearly as many or as much as on other part of the piece.

August 31, pretty generally affected with blight, although not so bad as other part. The so-called burned leaves are practically all dead. They died from the margin of the leaf towards the center. Very different from the way that the other plants have acted with blight.

September 4. much the same as on August 31. Blight still making some progress.

September 7. heavy frost which practically put an end to growth.

That there might be no confusion between the action of the Paris green and the Bug Death, two unsprayed rows were left between the two parts of the piece. On August 1 it was noticed that these two rows were badly infested with slugs and beetles, and that there were very few bugs on the part sprayed with Paris green. In the light of the experiments in the greenhouse, described beyond, the great number of bugs on these untreated rows was probably due to their being driven by the Bug Death.

#### EXPERIMENTS WITH BUG DEATH IN THE GREENHOUSE.

The heavy application (at the rate of 100 pounds to the acre) cleared the vines to which it was applied from bugs. Practically no dead bugs were found in the field and the superintendent of the company said that they very seldom found dead bugs under the plants, but that it cleared the vines when applied in sufficient quantities. In order to observe the effect of the Bug Death more carefully and accurately than is possible in a field test, potato plants were transplanted into the greenhouse in pots and the following experiments made, under the oversight of LeRoy H. Harvey.

The experiments with Bug Death were carried on as four distinct experiments. The potato plants were divided into four groups: each group being separated from the others and enclosed by mosquito netting. The treatment of each group and the observed results follow. The treatment began at 10 A. M.

#### FIRST EXPERIMENT.

*Statement of Conditions.* Three plants were taken. One plant was thoroughly covered with potato slugs, and they were allowed to remain unmolested until they were feeding freely. Then a liberal quantity of Bug Death was uniformly dusted over the plant with the slugs.

Results: Within half an hour after the application, the slugs were noticed to be crawling onto the underside of the dusted leaves which were free from the Bug Death.

After 6 hours a few of the slugs had left the treated plant and crossed over to undusted ones, and in so doing were obliged to climb over a piece of pasteboard 6 inches high which separated the undusted from the dusted plants. On the ground under the dusted plant were observed 3 dead slugs.

After 22 hours a few more were found dead under the dusted plant. More than half of the slugs had been driven from the plants even forcing themselves out from under the netting. In their eagerness to get away they left the plants which were free from the Bug Death. Clinging to the leaves of the dusted plant were a few slugs which on being touched fell to the ground. Although apparently alive, they were dead.

After 28 hours not much change was noticed, except a few more driven and the remaining ones were apparently in a sort of stupor.

After 52 hours all the slugs were driven from the upper part of stalks. A few were observed apparently feeding at the base of the plants.

After 68 hours about a third of the remaining few had crossed over to the undusted plants. Those remaining on the treated plant were eating heartily on the lower leaves, which had not been reached in the dusting. No stupor was noticeable.

The plants were allowed to remain several days after the sixth observation, but nothing further of note was observed.

## SECOND EXPERIMENT.

*Statement of Conditions.* In this experiment three plants were also taken. One plant was dusted as well and evenly as possible and then covered with the slugs.

Results: The slugs almost immediately and collectively sought the underside of the treated leaves.

After 6 hours several of the slugs were observed on the undusted plants to get to which they must have, as in No. 1, climbed over a strip of pasteboard 6 inches high separating the dusted from the undusted plants. Five slugs had succumbed to the Bug Death.

After 22 hours nearly three-fifths of the slugs had been driven from the treated plant forcing themselves under the netting and

escaping, as in No. 1, in preference to going on to the untreated plants. A few dead slugs were seen clinging to the branches.

After 28 hours there was a slight increase in the number of dead. The same semi-stupor apparent in the corresponding observation in No. 1 was here also evident.

After 52 hours a few more bugs had left the treated and crossed over to the undusted plants.

After 68 hours only a few bugs were remaining and these were eating heartily on the basal leaves, the stupor apparently having passed away.

Nothing of importance was observed in the following three days at the end of which time the experiment was discontinued.

### THIRD EXPERIMENT.

*Statement of Conditions.* The four plants which were taken in this group were all first thoroughly wet with water, then liberally sprinkled with Bug Death. The operation was repeated, first wetting and then sprinkling, until the leaves were evenly covered with Bug Death, and there was no dust apparent as such. The plants were next freely covered with slugs.

Results: As in experiments Nos. 1 and 2 the slugs soon sought the underside of the leaves.

After 6 hours a few of the slugs were noticed making their escape from under the netting and four were found dead under the plants.

After 22 hours there were a few more dead under the plants. There was a general leaving of the upper leaves for the basal. Almost half of the insects were driven as in previous experiments.

After 28 hours no marked change was noticed. A few more bugs had gone to the base of the leaves, and the semi-stupified condition was becoming evident.

After 52 hours there were only a few slugs left on the vines, the others apparently have been driven away.

After 68 hours the few remaining bugs were feeding freely on the basal leaves. The semi-stupor was not apparent.

During next three days no change was observed and the experiment was discontinued.

## FOURTH EXPERIMENT.

*Statement of Conditions.* This experiment differed from No. 1 only in that *all* the plants were first covered with slugs and then very liberally dusted with Bug Death.

Results: As in the three preceding experiments the slugs as soon as dusted started for the under side of the leaves and within an hour not a slug was left on the surface of the leaves.

After 6 hours a few dead slugs were found under the plants. Several had already started to escape.

After 22 hours several more dead slugs were found under the plants. Nearly one-half of the slugs had made good their escape by forcing themselves under the netting.

After 28 hours the number of the remaining slugs was somewhat decreased. The semi-stupor noticed in the corresponding observations of experiments Nos. 1, 2, 3, was also here slightly noticeable.

After 52 hours no change was noticeable. The few remaining slugs were feeding on the under side of the lower leaves.

After 68 hours only two slugs were remaining on the plants, and these were feeding on the basal leaves. The slugs showed no sign of any stupor.

During the three following days no observation worthy of record was made and so the experiment was discontinued.

Summary of the results. The effect most noticeable upon the bugs from the application of the Bug Death is its great driving property. The principle exodus of the slugs took place during the first night, and the subsequent escapings were also mostly made at night.

In the four experiments in the observations which took place after 28 hours, a semi-stupified condition was quite noticeable. The slugs would hang onto the under side of the leaves slightly curled up, apparently dead. When knocked to the ground they would slowly uncurl themselves and perhaps in an hour or so would be back again on the plants or more likely they would have made their escape under the netting. During the next forty-five hours there was an apparently complete recovery from the stupefaction. Only a small number of slugs were killed by the Bug Death. Whether these were killed by suffocation from the appli-

cation of the powder or from being poisoned by eating the Bug Death, the experiments do not conclusively show. In the third experiment the death rate was about as in the other trials and here the attempt was made to get rid of the dust by wetting. Whatever value the material has is dependent upon the strong dislike which the bugs show for it, rather than to any insecticidal qualities which it may have.

#### THE COST OF BUG DEATH.

The price as advertised ranges from 15 cents for a single pound to 8 cents in the largest package which the company puts out. At the rate applied in these experiments it would cost \$8.00 per acre for the material for each application. Two applications a fortnight apart would be needed to keep the potatoes free from bugs. When applied to vines not covering the ground an application at the rate of 40 pounds per acre was without effect, so it would seem that the second application must be as great as the first. To partly protect would cost for the Bug Death \$8.00 per acre while to thoroughly protect against bugs would cost \$16.00 for materials. The "Perfection Shaker" is a covered tin dish with small holes in the bottom. Applied with this shaker a man would be kept very busy and might develop a lame wrist in the attempt to apply 100 pounds in one day. In Aroostook county there are in the neighborhood of 25,000 acres of potatoes on which the bugs must be killed within a few days time. In the presidential election of 1896 the county polled 6,472 votes. It would take ten days for these voters to protect the potato plants from bugs applying Bug Death with the Perfection shaker. A farmer growing 20 to 50 acres would find it impossible to get the help necessary to apply Bug Death at the right time.

One pound of Paris green, or other arsenites applied at two different times will do all the work of 200 pounds of Bug Death. The Paris green can be applied with power sprayer at the rate of 20 to 30 acres a day, and a thorough application of Bordeaux mixture can be applied at the same time with only the added cost of materials (about 40 to 45 cents an acre). Reckoning a man's time at 15 cents an hour it would cost at least for materials and labor 18 dollars an acre to apply Bug Death twice. For two dollars and a half an acre can be treated four times with Bordeaux mixture and a reliable poison.

## SUMMARY.

It is claimed for Bug Death that it acts as an insecticide, fungicide and fertilizer.

Bug Death is chiefly zinc oxide. It contains no nitrogen, a mere trace of phosphoric acid and a small amount of potash.

*As an insecticide.*

At the rate 100 pounds per acre it freed potato vines from bugs.

At the rate of 40 pounds per acre it had no appreciable effect.

Bug Death drives the bugs and makes them leave the vines.

Bug Death kills comparatively few of the bugs.

*As a fungicide.*

Blight did not appear as soon nor as badly on plants to which Bug Death was applied at the rate (in 3 applications) of 180 pounds per acre as on untreated vines.

*Effect on foliage.*

At the rate of 40 pounds per acre no appreciable effect.

At the rate of 100 pounds per acre some of the leaves curled on the edges and finally died.

*As a fertilizer.*

As its only fertilizing constituent is a little potash it was not tested as a source of plant food.

*Its economy.*

Because of its high cost and slow application, no one growing any considerable amount of potatoes can afford to use Bug Death. The price of the labor required to apply Bug Death to one acre will buy the materials and spray two acres with Bordeaux and Paris green.

## BLACK DEATH AND ENGLISH BUG COMPOUND.

These two compounds have been quite extensively advertised and presumably more or less used in the State. Black Death is apparently Paris green diluted with gypsum to make weight and colored with charcoal. English Bug Compound depends upon white arsenic for whatever value it may have as an insecticide. Gypsum is employed to dilute the white arsenic and to give weight. As both of these goods depend upon arsenic as the

poison, they are no safer to use than any other arsenical insecticide. The English Bug Compound was not used in these experiments. Black Death was applied once on one-fourth acre by the Station at the rate of 40 pounds per acre and it had no appreciable effect on the bugs.

Each of these mixtures are sold, considering their composition, at very high prices and are uncertain and expensive insecticides. If English Bug Compound does not burn foliage, it is only because the manufacturers have used largely of the cheaper plaster, and sparingly of the more expensive white arsenic.

#### PRACTICAL CONCLUSIONS.

In fighting the Colorado potato beetle no adequate substitute for arsenical poisons has yet been found and there is little hope that any will be found. The efforts are now limited to finding cheaper or more effective compounds of arsenic than Paris green.

The arsenical insecticides are best applied with water in the form of a fine spray as soon as the slugs appear. Unless applied in connection with Bordeaux mixture it is safest to use lime with all arsenical compounds. The applications should be repeated as often as necessary.

Some of the cheaper arsenoids were in these experiments as effective as Paris green. There is no reason for using them or Paragrene in place of Paris green unless they can be had at a lower price.

Lead arsenate is the most satisfactory of the insecticides used by the Station. It is apparently slower in action than the copper compounds of arsenic, but it can be more evenly applied and it adheres firmly to the foliage without burning.

#### DIRECTIONS FOR SPRAYING.

On application the following special publications of the Station will be mailed free:

Condensed Directions for Spraying the Potato.

Condensed Directions for Spraying Apples.

How to Fight Cucumber Enemies.

## ACKNOWLEDGMENTS.

Acknowledgment is hereby made for the following gifts to the Station during 1900:

Chinese Artichokes, Artichokes from Italy, Seed Wheat, Seeds from Japan and Italy, Lawn Grass Seed from France—United States Department of Agriculture.

Carnations, Rooted Cuttings—Albert M. Herr, Lancaster, Pa.

Sulphate, Carbonate and Muriate of Potash and Kainit—German Kali Works, New York City.

Nitrate of Soda—Propaganda for Use of Nitrate of Soda, New York City.

Seed Potatoes—George W. P. Jerrard Company, Caribou.

Garden and Acme Corn Planters—Potato Implement Co., Traverse City, Mich.

Seat Spring for Farm Wagons—Cramer & Co., Bradley, Mich.

The following newspapers and other publications are kindly donated to the Station by the publishers:

Agricultural Epitomist, Indianapolis, Ind.

Agricultural Gazette, Sidney, New South Wales.

American Cultivator, Boston, Mass.

American Fertilizer, Philadelphia, Pa.

American Gardening, New York City.

American Grange Bulletin, Cincinnati, O.

American Grocer, New York City.

American Miller, Chicago, Ill.

Baltimore Weekly Sun, Baltimore, Md.

Bangor Weekly Commercial, Bangor, Me.

Beet Sugar Gazette, Chicago, Ill.

Breeders' Journal, Himrods, N. Y.

Canadian Horticulturist, Grimsby, Ont.

Chronique Agricole, Lausanne, Switzerland.

Country Gentleman, Albany, N. Y.  
 Dairy World, Chicago, Ill.  
 Detroit Free Press, Detroit, Mich.  
 Elgin Dairy Report, Elgin, Ill.  
 Farmer's Advocate, London, Ont.  
 Farmer's Guide, Huntington, Ind.  
 Farmer's Home, Dayton, O.  
 Farmer's Tribune, Des Moines, Iowa.  
 Farm Home, Springfield, Ill.  
 Farm and Home, Chicago, Ill.  
 Farm Journal, Philadelphia, Pa.  
 Farm-Poultry, Boston, Mass.  
 Farmer's Magazine, Springfield, Ill.  
 Farmer's Review, Chicago, Ill.  
 Farmer's Voice, Chicago, Ill.  
 Farming, Dayton, O.  
 Florists Exchange, New York City.  
 Florists Review, Chicago, Ill.  
 Forester, Princeton, N. J.  
 Fruit, Dunkirk, N. Y.  
 Golden Egg, St. Louis, Mo.  
 Green's Fruit Grower, Rochester, N. Y.  
 Hoard's Dairyman, Ft. Atkinson, Wis.  
 Holstein Friesian Register, Brattleboro, Vt.  
 Homestead, Des Moines, Iowa.  
 Horticultural Visitor, Kinmundy, Ill.  
 Inland Poultry Journal, Indianapolis, Ind.  
 Jersey Bulletin, Indianapolis, Ind.  
 Journal of the Royal Agricultural Society, London, England.  
 Louisiana Planter, New Orleans, La.  
 Lewiston Weekly Journal, Lewiston, Maine.  
 Maine Farmer, Augusta, Maine.  
 Mark Lane's Express, London, England.  
 Market Garden, Minneapolis, Minn.  
 Massachusetts Ploughman, Boston, Mass.  
 Mirror & Farmer, Manchester, N. H.  
 Modern Miller, St. Louis, Mo.  
 Montana Fruit Grower, Missoula, Mont.  
 National Farmer and Stock Grower, National Stock Yards, Ill.

National Rural and Family Magazine, Chicago, Ill.  
National Stockman and Farmer, Pittsburg, Pa.  
New England Farmer, Boston, Mass.  
New England Florist, Boston, Mass.  
New England Homestead, Springfield, Mass.  
New York Farmer, Port Jervis, N. Y.  
New York Produce Review, New York City.  
North American Horticulturist, Monroe, Mich.  
Northern Leader, Fort Fairfield, Me.  
Northwestern Miller, Minneapolis, Minn.  
Oregon Agriculturist, Portland, Oregon.  
Pacific Coast Dairyman, Tacoma, Wash.  
Park and Cemetery, Chicago, Ill.  
Practical Dairyman, Spencer, Ind.  
Practical Farmer, Philadelphia, Pa.  
Practical Industry, Gouverneur, N. Y.  
Public Ledger, Philadelphia, Pa.  
Ruralist, Gluckheim, Md.  
Rural Californian, Los Angeles, Cal.  
Rural New Yorker, New York City.  
Rural Topics, Morgan City, La.  
Southern Farm Magazine, Baltimore, Md.  
Southern Farmer, New Orleans, La.  
Southern Planter, Richmond, Va.  
Southwest, Springfield, Mo.  
Southwestern Farmer, Wichita, Kans.  
Strawberry Specialist, Kittrell, N. C.  
Sugar Beet, Philadelphia, Pa.  
Turf, Farm and Home, Waterville, Me.  
Vick's Magazine, Rochester, N. Y.  
Weekly Union, Manchester, N. H.  
Western Agriculturist, Chicago, Ill.  
Western Creamery, San Francisco, Cal.  
Western Fruit Grower, St. Joseph, Mo.  
The World, Vancouver, B. C.

## METEOROLOGICAL OBSERVATIONS.

The instruments used at this Station are the same as those used in preceding years, and include: Wet and dry bulb thermometers; maximum and minimum thermometers; thermograph; rain-gauge; self-recording anemometer; vane; and barometer. The observations at Orono now form an almost unbroken record of thirty-one years.

The mean temperature for 1900 was about one degree above the average for 32 years. The greatest monthly variations from the average were in April and October, which were  $3^{\circ}.74$  and  $5^{\circ}.55$  respectively higher than usual. The total precipitation, 53.8 inches, was higher than that recorded at any one year at this Station since 1870, when the fall was 58.04 inches. The rainfall was very unequally distributed through the year, April being dry, while in May the fall was more than double the average, thus greatly delaying planting. July and August were so dry that crops in this section suffered greatly. Latitude,  $44^{\circ}, 54', 2''$  N. Longitude  $68^{\circ}, 40', 11''$  W. Elevation above the sea, 150 feet.

# METEOROLOGICAL SUMMARY FOR 1900. Observations Made at the Maine Experiment Station.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Mean.	Total.
Highest barometer . . . . .	30.52	30.49	30.31	30.24	30.12	30.09	29.99	30.05	30.21	30.38	30.33	30.28	30.24	.....
Lowest barometer . . . . .	28.81	28.55	29.16	29.20	29.33	29.37	29.28	29.48	28.90	29.36	28.84	29.19	29.12	.....
Mean barometer . . . . .	29.74	29.77	29.71	29.73	29.74	29.72	29.73	29.83	29.85	29.98	29.82	29.81	29.79	.....
Highest temperature . . . . .	46°	50°	52°	78°	88°	86°	88°	94°	93°	76°	72°	45°	.....	.....
Lowest temperature . . . . .	-13°	-21°	-10°	21°	26°	38°	47°	43°	27°	19°	9°	-16°	.....	.....
Mean temperature . . . . .	17°.82	20°.49	26°.58	44°.12	49°.49	63°.39	68°.10	66°.30	53°.37	51°.55	35°.90	18°.65	43°.46	.....
Mean temperature for 32 years . . . . .	16°.04	19°.28	27°.53	40°.38	52°.29	62°.03	67°.01	65°.10	60°.22	46°.00	34°.26	20°.31	42°.54	.....
Total precipitation in inches . . . . .	8.14	6.75	5.47	2.01	8.24	3.83	2.53	1.58	2.94	5.70	4.59	2.02	.....	53.80
Mean precipitation for 32 years . . . . .	4.37	4.15	4.24	2.82	3.64	3.62	3.33	3.57	3.35	4.07	4.44	3.73	.....	45.33
No. of days with precip. of .01 in. or more	10	10	5	7	13	7	9	10	7	8	11	6	.....	103
Snow fall in inches . . . . .	26.30	23.00	16.50	.....	.....	.....	.....	.....	.....	.....	7.75	11.75	.....	85.30
Average snow fall for 32 years . . . . .	23.20	21.80	17.10	5.80	.....	.....	.....	.....	.....	0.93	7.80	16.80	.....	93.43
Number of clear days . . . . .	14	10	12	10	9	14	9	11	15	11	7	11	.....	133
Number of fair days . . . . .	4	2	8	5	8	5	11	9	6	8	7	4	.....	77
Number of cloudy days . . . . .	13	16	11	15	14	11	11	11	9	12	16	16	.....	153
Total movement of wind in miles. . . . .	5844	6920	8308	7137	6137	5063	5131	4665	4569	5452	6624	4549	.....	.....

# REPORT OF THE TREASURER.

Maine Agricultural Experiment Station in account with the United States appropriation, 1899-1900.

DR.

To receipts from the Treasurer of the United States as per appropriation for the fiscal year ending June 30, 1900, as per act of Congress approved March 2, 1887..... \$15,000 00

CR.

## By salaries:

(a) Director and administration officers.....	\$2,360 91	
(b) Scientific staff.....	3,666 68	
(c) Assistants to scientific staff.....	1,730 28	
(d) Special and temporary services.....	55 06	
Total .....		\$7,812 93

## Labor:

(a) Monthly employees.....	\$755 00	
(b) Daily employees .....	713 23	
Total ....		1,468 23

Publications.....	26 65
Postage and stationery .....	326 29
Freight and express .....	187 16
Heat, light and water .....	1,064 41

## Chemical supplies:

(a) Chemicals .....	\$308 37	
(b) Other supplies .....	68 89	
Total .....		377 26

## Seeds, plants and sundry supplies:

(a) Agricultural.....	\$66 95	
(b) Horticultural.....	160 52	
(c) Miscellaneous.....	418 93	
Total .....		646 40

Fertilizers .....	171 73
Feeding stuffs .....	1,107 02
Library .....	243 34
Tools, implements, and machinery .....	190 78
Furniture and fixtures.....	262 01
Scientific apparatus.....	58 37

Maine Agricultural Experiment Station in account with Creamery Inspection  
for the year ending December 31, 1900.

DR.	
To fees for calibrating glassware .....	\$53 34

CR.	
By expense calibrating glassware .....	\$53 34

Maine Agricultural Experiment Station in account with "General Account" for  
the year ending June 30, 1900.

DR.	
To balance from 1898-9 .....	\$1,305 29
Sales of produce, etc.....	3,857 20
	\$5,162 49

CR.	
By salaries .....	\$306 33
Labor .....	1,397 66
Stationery .....	8 04
Heat, light and water .....	22 00
Seeds, plants, and sundry supplies.....	1,009 70
Feeding stuffs .....	41 93
Tools, implements and machinery .....	2 76
Furniture and fixtures.....	55 87
Scientific apparatus .....	5 93
Live stock .....	13 55
Traveling expenses .....	11 75
Contingent (chiefly insurance) .....	190 08
Buildings and repairs .....	1,460 95
Balance to 1900-1901 account .....	636 00
	\$5,162 49

## Live stock:

(a) Horses .....	\$90 00	
(c) Sheep .....	18 00	
(e) Poultry .....	32 47	
(f) Sundries .....	211 77	
Total .....		\$352 24

## Traveling expenses:

(a) In supervision of Station work.....	\$162 12	
(b) In attending various meetings .....	135 40	
Total .....		297 52

## Buildings and repairs:

(a) New buildings .....	407 66	
Total .....		\$15,000 00

ISAIAH K. STETSON, *Treasurer.*

I, the undersigned, duly appointed Auditor of the Corporation, do hereby certify that I have examined the books of the Maine Agricultural Experiment Station for the fiscal year ending June 30, 1900, that I have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been \$15,000.00, and the corresponding disbursements, \$15,000.00; for all of which proper vouchers are on file and have been examined by me and found correct.

And I further certify that the expenditures have been solely for the purposes set forth in the act of Congress approved March 2, 1887.

A. W. HARRIS, *Auditor.*

Maine Agricultural Experiment Station in account with Fertilizer Inspection for the year ending December 31, 1900.

## DR.

To balance from account of 1899.....	\$253 69	
Receipts for licenses.....	2,555 00	\$2,808 69

## CR.

By collection and analyses of samples .....	\$1,861 32	
Executive and office expenses.....	700 00	
Balance to account of 1901....	247 37	\$2,808 69

Maine Agricultural Experiment Station in account with Feed Inspection for the year ending December 31, 1900.

## DR.

To receipts for inspection tags, 1900.....	\$1,917 76	
Balance to account of 1900.....	666 53	\$2,584 29

## CR

By balance carried from 1899 account....	\$786 07	
Collection and analyses of samples .....	628 54	
Tags .....	469 68	
Executive and office expenses.....	700 00	\$2,584 29

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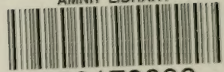








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